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NSC

Next in Doncaster

Vol 23 No8 September 2015

New London monument

Long spans for City offices

Sports centres on Oldham

CE Marking guidance update

Cover Image
The Monument Building, London
Architect: Make Architects
Structural engineer: Arup
Steelwork contractor: Severfield
Main contractor: Skanska
Client: Skanska

BCSA

TATA STEEL

SCI Steel Knowledge

September 2015 Vol 23 No 8

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MARWE2002-B

Steady outlook for steel

Nick Barrett - Editor

Financial markets have been rocked again recently, raising fears that we might be looking at a new financial crisis. Calmer minds have been advising however that the roller-coaster rides of financial markets usually bear little relation to the real economy.

The latest steel sector forecasts from Construction Markets are probably a far better guide to the likely short-term future of the construction industry, and steel's share of it, than any stock or bond market related crystal ball gazing. The construction market's future looks like being one of continued steady progress, which is more preferable to the steel sector and its clients than the ups and downs of the financial markets.

The overall forecast for steel construction for this year is a rise of 5.4%, following last year's 5.8%. The pace of growth is expected to slow to a more sedate 2.3% next year but it should be over 2% a year up to 2019. Within this, the office sector shows a strong outlook with consumption of structural steelwork in the sector rising above 100,000 tonnes again this year and continuing to grow strongly to 2019 when consumption of over 120,000 tonnes will be achieved.

This success is well deserved. The office sector has been a stand out success story for steel for some 30 years now, and there is no sign of that changing. In this issue of NSC we can see some great examples of why steel is chosen as the framing material for some 70% of office developments, one adjacent to London's Great Fire memorial at Monument and another blending in with an existing crescent of offices at the City's Finsbury Circus.

A BREEAM 'Excellent' rating is being sought for the Grade A office development at Monument, where selecting steel for the frame maximised the number of floors on a site with very tight planning restrictions because of the adjacent Monument. The design was streamlined by using BIM, that steelwork contractors have taken to with enthusiasm, allowing the steel tonnage to be optimised. Despite tight site constraints, the steelwork was erected ahead of schedule.

The Finsbury Circus project team faced some challenges unique to that site in the City, fronting a square where a major tunnel portal for the Crossrail project is being built. Noise and other disturbance to an adjacent prestige hotel had to be minimised, so offsite fabrication became a major plus point.

The latest RIBA future trends survey confirms this picture for the construction industry, with workload growth in architectural practices of 8% reported, and staffing levels up 6% over the past year. Practices in the north of England were the most optimistic. Commercial workloads are expected to show strong growth of 13%, although that was down from the 16% expected back in June.

Overall then, the future for office building is looking brighter than it did just a few years ago, and steel looks like remaining the structural framing solution of choice for most developers, architects and engineers for the foreseeable future.

NSC

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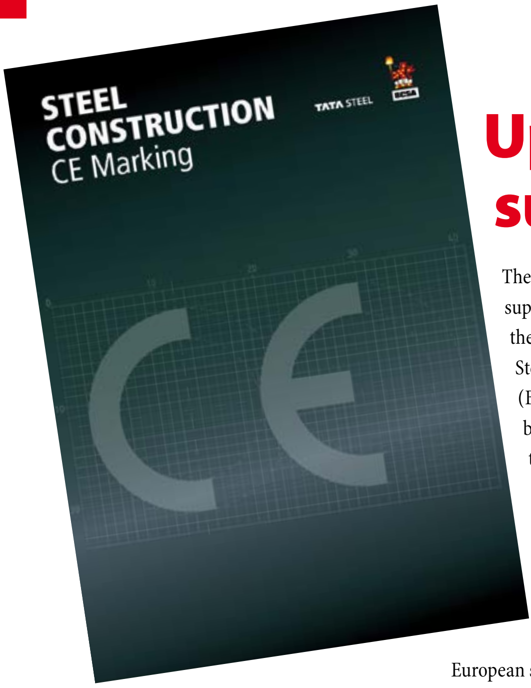


Updated CE Marking supplement now available

The CE Marking supplement produced by the British Constructional Steelwork Association (BCSA) and Tata Steel has been updated to include the latest procedure for selecting the Execution Class for a structure.

CE Marking for all construction products covered by a harmonised European standard or conforming to a European Technical Assessment became mandatory on 1 July 2013.

For fabricated structural steelwork, CE Marking became mandatory on 1 July 2014. This represents a major development for engineers, contractors and steelwork specialists, as it demands careful attention to the new obligations imposed.

The original 20-page supplement highlighted how the steel construction sector had been working behind the scenes towards achieving CE Marking. Importantly, it spelt out in detail what it means for the rest of the construction sector and what you need to do to comply with the Construction Products Regulation.

The updated 18-page supplement includes an important change in the selection of Execution Class, which should now be based on the recommendations given in normative Annex C of BS EN 1993-1-1:2005+A1:2014 and its supporting National Annex.

The supplement is available for free at: http://www.steelconstruction.info/Steel_construction_news#Steel_construction_.E2.80.93_CE_Marking

Birmingham's tallest office tower given green light by city planners

A steel frame has been chosen for a 26-storey tower in Birmingham that will be the city's tallest office building.

Situated at 103 Colmore Row, the Doone Silver Architects designed structure will replace the site's existing landmark NatWest Tower.

A replacement scheme was stalled earlier this year after councillors said they were worried that if the replacement tower falls through, they will be left with an open plot on a prominent city centre conservation area site.

"The project will use an existing basement so a lightweight framing material is required," said Doone Silver Architects' Chris Blow. "For this reason a steel-framed solution is the ideal choice."

Peter Graham, construction director of Sterling Property Ventures, said: "We're very pleased that Birmingham city council has acknowledged our unwavering commitment to this project and this great city.

"It means we can now move this project off the drawing board and onto site, replacing an outdated, inefficient building with a modern, landmark office development that Birmingham can be proud of."

The majority of the building – 19 floors – will be used as office space with space for 2,000 workers. It also incorporates leisure space including a winter garden, a cafe and a restaurant and bar at the top of the building with a 360-degree view of the city. Work is due to be completed by 2018.

Liverpool expo centre opens with healthcare show

One of the largest steel-framed structures in the north west of England, the Exhibition Centre Liverpool (ECL), opened its doors for the first time this month and hosted Wound Expo 2015, the exhibition for nurses.

Situated on Liverpool's riverfront, the ECL is connected by a bridge to the ACC Liverpool, one of the country's biggest convention centres and arena.

The ECL is 164m-long by 85m wide and offers 8,100m² of exhibition space. It has three large halls, each measuring 60m × 45m, that can be used separately or opened up via sliding partitions into one large space.

The building's frontage, overlooking the River Mersey, features a fully glazed double-height public concourse that runs the full length of the structure. Above the main concourse there is a first floor level accommodating meeting rooms and offices.

Steel construction played an integral role in the building of the ECL (see *NSC Oct 2014*).

The roof of the structure consists of a two-way spanning grillage of long-span trusses, each with a minimum overall depth of 3.5m. The roof has a 1.5 degree pitch and this was built into the grillage with varying truss depths.

The trusses were designed to absorb some big loads as the roof of the ECL has rigging and lighting hung from it. Each 5m × 5m grid of the roof steelwork can take maximum single loads of either 5t in hall C or 3t in halls A and B.

Halls A and B are identical with a height of 10.5m to the underside of the trusses, but hall C has extra headroom and is 16m high. This extra height will allow hall C to accommodate rock and musical stage shows.

Working on behalf of main contractor ISG, Billington Structures fabricated, supplied and erected 2,000t of steelwork for the ECL.

Royal opening for The Kelpies

Photo: Peter Sandground/Scottish Canals

The Kelpies have received a royal seal of approval as Her Royal Highness Princess Anne has officially opened what are said to be the world's largest pair of equine sculptures.

HRH the Princess Royal led a flotilla of around 40 boats along the Forth & Clyde Canal to the sculptures, before meeting some of the groups and individuals involved in the project.

The colossal Kelpies, which tower over a new section of the historic Forth & Clyde Canal, are the centrepieces of the £43M Helix project.

The scheme, driven by a partnership of Falkirk Council and Scottish Canals and supported by an award of £25M from the Big Lottery Fund, has transformed 350 hectares of underused land between Falkirk and Grangemouth into a vibrant parkland, visitor attraction and marine hub with the canal and The Kelpies at its heart.

More than one million visitors from all over the world have stood in the shadow of the sculptures since their unveiling in April 2014, bringing renewed vibrancy and income to the area and boosting the local economy by an estimated £1.5m per year.

Councillor Adrian Mahoney, Falkirk Council's spokesperson for Culture, Leisure and Tourism, said: "It seems particularly appropriate that Princess Anne – with her love of horses – has agreed to officially open the Kelpies, the world's largest equine sculptures. Standing at around 30m tall, they dominate the skyline and act as a beacon to tourists from all over the world."

The complex steelwork for The Kelpies was fabricated, supplied and erected by S H Structures.

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

Truss installed for Anfield's new main stand

Forming an integral part of the redevelopment of Liverpool FC's Anfield stadium, the 650t steel roof truss for the new main stand has been lifted into place.

Having been delayed for one day due to high winds, work started just after 9am, when the 140m long structure was lifted up above the stand by two of the largest cranes in the country.

Within an hour of the work starting the truss was moved over the incomplete steel frame for the new main stand.

It then stayed hovering between the new and old sections of the stand for about two hours while more weights were added to the cranes to allow them to safely lower it into position.

The structure was then lowered onto two new towers, either side of the stand, and fixed into place. Work then took place to secure the truss and release it from the cranes.

The work was the latest development in the stadium's expansion, and is set to make the main stand one of the largest all-seater single stands in Europe's top divisions.

The redeveloped stand, on target for completion during the 2016/17 season, will comprise three tiers with the existing lower tier featuring a widened player tunnel, new team benches, a media platform and wheelchair viewing positions.

The redevelopment plans will add around 8,500 seats and take the Main Stand capacity to over 20,000, increasing the overall capacity of Anfield to around 54,000.

Working on behalf of main contractor Carillion, steelwork for the project is being fabricated, supplied and erected by Severfield.

NEWS IN BRIEF

AceCad Software has released its BIMReview V8, a collaborative Building Information Modelling (BIM) project review tool for use across construction projects. The company says it is a low cost, feature rich tool, to import BIM models and associated data from multiple CAD authoring tools to consolidate effective review and visual communication.

Wessex Galvanizers (part of the Wedge Group) is playing an important part in the ongoing restoration of the fire-stricken Hastings pier. The company has provided its hot-dip galvanizing protection to over 250t of steel used to fabricate components of the new pier structure.

NEO Bankside, the first major residential scheme in the UK to feature an external steel bracing system and a 2012 SSDA Commendation winner, has been shortlisted for this year's Stirling Prize. The luxury flats are located behind the South Bank's Tate Modern in London and were designed by architect Richard Rogers.

Billington Structures has installed the first truss for a £60M hangar at RAF Brize Norton that will be used to maintain Airbus A400 Atlas four-engine military transport aircraft. In total the company will erect approximately 3,000t of steel for the hangar and an associated three-storey office block.

Barrett Steel has ranked on both the Sunday Times HSBC International Track 200 league table and the Yorkshire Insider's annual Top 500. Fifteen companies from Yorkshire, including Barrett Steel, featured on the list of the 200 UK businesses with the fastest growth in overseas sales. The International Track 200 ranks companies with total sales of more than £25M that have international sales of at least £1M.

AROUND THE PRESS

Construction News
21 August 2015
Interserve delivers red-brick refurb
[University of Birmingham] – They [project team] relied upon a series of temporary platforms on either side of the building envelope, so that the steel beams could be passed through the open window reveals. Sequencing of steel delivery and placing was tailored to prevent any overloading of the structure.

Building Magazine
24 July 2015
The Broadway
[Westfield Bradford] – "H&M wanted to create a 'pop up' level in the roof, above the store, which meant extra structural steel had to be added. This is where steel's flexibility comes to the fore. It's easy to strengthen the structure simply by adding more steel. With concrete it would have been much more difficult," Keith Whitmore, Westfield's Head of Design and Construction.

Building Magazine
24 July 2015
Longbridge town centre regeneration
"We like using steel, because of its speed and flexibility, which makes it ideal for retail, where the tenants requirements can change," explains St Modwen's Construction Manager Mark Batchelor.

Liverpool Echo
22 July 2015
Anfield Main Stand's new huge roof truss set to be lifted into place
Beginning at 7.30am the truss will be raised from a podium and is expected to be level with the top of the Main Stand's new steel structure by 9am before rising above it. Between 1.30pm and 2pm the truss will be lifted above the existing Main Stand, landing on the towers between 2pm and 3pm.

Construction News
3 July 2015
Mace puts on a South Bank show
[CIT Tower] - The core has been extended upwards to accommodate the new 11 floors. "To keep the loads to a minimum, the structure for these floors comprises steelwork wrapped around the core and lightweight concrete floor slabs," says Mace's Project Director Shaun Tate.

Steel supports power station project

Steel contractor Adey Steel will soon begin work to fabricate and install more than 700t of façade retention steelwork at Lots Road power station in Chelsea, London.

Built in 1904 the iconic riverside site has remained unused since its decommissioning in 2002. Developers will soon begin building 706 homes on the eight-acre site including two towers, one of which will be 37 storeys high.

The steelwork will comprise three core towers along the length of the interior of the building, each tower will have multiple 'branches' at four levels reaching out to support ring beams fixed to the interior walls.

These temporary structures will remain in place during strip out of the existing steelwork and until a replacement steel frame to suit the buildings new use is erected.

The project is said to be challenging due to the scale of the existing building and the legacy of basements and pits in the internal floor.

The 100-year old steelwork from the original build needs to be negotiated as the new supporting steel is erected; as a result crane and access equipment has been tailored to suit these limiting conditions.

Adey Steel Operations Director Ross Brown commented: "This is a landmark project for us, to be involved in one of the largest façade retention schemes in London to date is testament to our business. We have been working hard with our client studying the design solutions for the project ensuring best value and buildability, and we now look forward to the project getting under way."

Voortman launch 3D plasma bevels

Dutch-based steel processing machinery manufacturer Voortman has released a new 3D plasma bevel which it says will improve cutting quality.

The new design with gas valves positioned as near as possible to the end process (plasma arc) offers advantages to the customer claims Voortman.

The further the gas valves are from the end process, the harder it is to control the gas specifically at this point. This could result in a longer post flow and larger deviations in the gas flow.

The Voortman 3D bevel unit is equipped with 3D collision protection that will prevent damage to the torch in the event that it collides with the processing material.

To save time the 3D collision protection for the Voortman 3D bevel unit uses a magnet holder where the torch can easily be remounted back in the holder to minimise downtime after a collision.

Northerly outpost gets new school and community centre

Work is progressing on schedule for a £48M school and community leisure centre project in one of the UK's most northerly towns.

The Wick Community Campus will replace three existing schools (one secondary and two primary) with a single educational facility consisting of three interconnected teaching wings.

Adjacent to the school structure, the campus will also include a community block housing a 25m-long swimming pool, library and fitness suite,

Both of these large buildings are being built with structural steelwork, with the team citing a number of reasons for this design choice.

"The location and logistics played a key role in choosing steel for this project. All materials have to arrive via a long road journey and steel is easily transported," says hub North Scotland Project Director Ian Leslie.

Working on behalf of hub, main contractor Galliford Try will complete the job in time for the autumn term of 2016. More than 1,200t of structural steelwork is being supplied and erected on the project by BHC.

Clamps specified for Forth Crossing

Lindapter Type AAF clamps have been specified for securing the cable management systems along the entire Forth Replacement Crossing.

Due to open in 2016, the new road bridge, linking Edinburgh with the county of Fife will be the longest three-tower, cable-stayed bridge in the world and the longest to feature cables that cross mid-span.

The construction team will use Lindapter's adjustable Type AAFs to connect cable mounting plates back to a wide range of steel sections, allowing the same product to be used throughout the project.

The Type AAFs provide full lateral adjustability, enabling the cable management systems to be quickly and easily manoeuvred into place before tightening with simple hand tools.

Lindapter says that compared to drilling or welding, the Type AAF can be installed quickly and conveniently without the need for hot work permits, which significantly reduces construction time and labour costs.

Lindapter connection methods are also said to offer a substantial time saving by taking only 1.5 hours to install giving engineers a quick turnaround on projects.

Lincoln transport hub will be driven by steel

A £29M scheme that will improve Lincoln's transport infrastructure and modernise its city centre will be constructed predominantly with structural steelwork.

The Lincoln transport hub project will see main contractor Willmott Dixon construct a new bus station, improve the current train station, create a dual-purpose footbridge to link St Mary's Street and Tentercroft Street and deliver a 1,000 space multi-storey car park.

It is expected that the steel-framed bus station, which will replace an outdated facility, will start on site early next year, around the same time as the steel composite footbridge is due to be erected.

The steel-framed car park will require approximately 1,200 tonnes of steel and will form one of the final pieces of the scheme with work due to begin in 2017. All of the steelwork packages for the Lincoln hub are currently out to tender.

Cllr Colin Davie, Executive Member for Economic Development at Lincolnshire County Council, said: "This project, along with the major road improvements being made by the county council, will ensure that the city remains well-placed for business growth over the coming years."

David Reid, operations manager at Willmott Dixon said: "This is a huge step forward in the council's ambitions for an integrated transport system which will transform and improve the first impressions for visitors and pedestrian connectivity to this great historical city."

Diary

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

Tuesday 15 September 2015
Fire Design of Beams and Columns
1 hour lunchtime webinar free to BCSA and SCI members, offering an overview on Fire Design of Beams and Columns

Tuesday 22 September 2015
Steel Connection Design
This course is for designers and technicians wanting practical tuition in steel connection design.
Birmingham

Tuesday 29 September 2015
Steel Frames and Disproportionate Collapse Rules
This one day course provides a solid introduction in the design of steel-framed buildings to avoid disproportionate collapse.
Sheffield

Thursday 1 October 2015
Steel Building Design to EC3
This course will introduce experienced steel designers to the Eurocode provisions for steel design.
Edinburgh

Tuesday 13 October 2015
Latest Developments in Composite Beam Design
1 hour lunchtime webinar free to BCSA and SCI members, offering an overview on the latest developments of Composite Beam Design.

Wednesday 14 & Thursday 15 October 2015
Essential Steelwork Design
This course introduces the concepts and principles of steel building design to EC3.
Bristol

Tuesday 3 November 2015
Steel Building Design to EC3
This course will introduce experienced Steel designers to the Eurocode provisions for steel design.
Watford

Steel supports sporting life

The large open plan sports hall at Oldham Sports Centre

Structural steelwork has proven to be the ideal framing material for a new sports centre in Oldham.

FACT FILE
Oldham Sports Centre
Main client: Oldham Metropolitan Borough Council
Architect: GT Architects
Main contractor: Willmott Dixon
Structural engineer: Ramboll
Steelwork contractor: EvadX
Steel tonnage: 500t

Once the textile spinning capital of the world and a renowned centre for structural and mechanical engineering, Oldham has in recent times had to reinvent itself as its traditional industries have declined.

Many of the 300 hundred plus textile mills that once dotted the town's landscape can still be seen, although today they accommodate and serve different industries and trades.

Between the distinctive and traditional red brick buildings, numerous new structures are changing and enhancing the townscape as Oldham invests in its future.

A number of prestigious building projects have been completed recently (see boxes), most of them using steel as the main framing solution.

Currently under construction in the town centre is a new £15M sports centre, a replacement facility for Oldham that will contain far more amenities for the local community.

Oldham Council Leader Jim McMahon says: "A new state-of-the-art flagship facility for Oldham is an important piece of the regeneration jigsaw coming together."

The centre boasts a 25m eight-lane swimming pool; a smaller learner pool; an eight-court sports hall; an 80-station fitness studio and a four-rink indoor bowls hall.

In addition to these sporting facilities the centre will also have 250 spectator seats for the main pool and 150 competitor seats at pool side; flexible seating for 250 people in the sports hall; exercise studios; separate changing facilities for dry sports, the swimming pools and fitness suite, as well as a cafeteria and outside parking.

A large 15t truss forms the pool area

Main contractor Willmott Dixon started on site mid-2014 and handover of the project is scheduled for 23 October. As with most projects these days, the programme is tight and efficiencies are key to completing the job on time.

"This job was procured through a collaborative framework approach," explains Willmott Dixon Operations Director Mike Lane. "This helped us get subcontractors like EvadX on board quickly allowing them to start the steel design and fabrication process early, which in turn meant that steel arrived on site early in the programme."

Getting the steel on site as soon as possible has helped the project team stay ahead of the game. With the steel frame mostly up and completed by Christmas, follow-on trades, such as cladding and concreting, were so also able to get an early start on site.

Overall the steelwork consists of three large connected braced frames. As well as bracing, stability is also provided by strategically placed moment frames and sway frames.

A three-storey middle core section houses the changing rooms on the ground floor, fitness and dance studios on the floor above and the bowling rinks and a plant deck on the uppermost level.

Either side of the three-storey section are two open column-free zones, one containing the two pools and the other measuring 45m × 36m accommodating the sports hall.

The large sports hall is formed with a series of 36m-long trusses, brought to site in two sections, bolted together on the ground and lifted into place as one large member. The trusses incorporate a pitch to form the roof and so their depth varies from 1.1m up to 2.8m deep at the apex.

The bowling area is another large column-free area and it is formed by a series of 20m-long rafters, linked together by tubular bracing.

The design of the floor of the bowling area, which is also the roof for the first floor fitness suite, had to take vibration into account.

"Although we largely designed the steelwork, Ramboll oversaw the project and had a lot of input for loadings and vibration. For the bowling rink, floor vibration could be an issue so we had to use large 914UKBs to help absorb any movement," explains EvadX Project Manager Steve Morris.

"If for instance line dancing was to take place, that would cause far more vibration than bowling so we had to over-design the steelwork for all eventualities," adds Mr Lane.

The most interesting and challenging steelwork is positioned above the main pool and takes the form of a large girder truss.

Weighing 15t and measuring 32m-long by 2.8m deep, the truss was brought to site as two fully fabricated halves that were then bolted together and then craned into place by two mobile cranes in a tandem lift.

This large steelwork element is an essential part of the steel design as it supports a second floor plant deck that is adjacent to the bowling rink and overhangs the pool.

Positioned at 90 degrees to this large girder truss is another truss that performs two tasks. Its lower boom supports the first floor dance studio, while the top boom supports the pool's roof.

"This truss had to be brought to site piece-small and then erected on site. It is 3m deep because it will incorporate windows overlooking the pool and consequently it would have been too large to be transported by road," explains Mr Morris.

Both of these trusses connect back to a large 500mm diameter tubular column that forms the cornerstone to the pool area's steelwork.

EvadX also installed the project's metal decking and precast lift shafts and precast terracing units for the pool's seating.

Oldham Sports Centre is due to be completed in October and the facility will open before Christmas.

Educating in steel

Oldham has produced a rich vein of steel-framed projects for Willmott Dixon. Recently the company has constructed three academies and a building for Oldham College, while in 2014 it completed the Greater Manchester Sustainable Engineering UTC, which is located adjacent to the Oldham Sports Centre.

A total of 233t of steel was fabricated, supplied and erected by Leach Structural Steelwork for this project. Leach also installed metal decking, precast stairs and lift shafts.

The £9M building opened in September and houses full-time education facilities for 14-18 year-olds providing opportunities for them to earn qualifications and experience for in-demand skills and become the next leaders in engineering.

Olympic legacy at Royton Sports Centre

A few miles down the road from the Oldham Sports Centre, Willmott Dixon is currently constructing another similar project that is reusing equipment from the London 2012 Olympics.

Royton Leisure Centre is a two-storey steel-framed building containing a 25m-long six-lane swimming pool; a learner pool; an 80-station fitness gym, and two exercise/dance studios.

Filtration equipment used at Royton has been sourced from training and warm-down pools that were dismantled after the London Olympic Games.

EvadX has erected a total of 200t steel for this project.

The Next big thing

A large 25m-high distribution centre for Next is rapidly taking shape on the outskirts of Doncaster.

FACT FILE
Next Distribution Centre, Doncaster
Main client: Next
Architect: SiCa
Main contractor: Bowmer & Kirkland
Structural engineer: Adept Consulting Engineers
Steelwork contractor: Billington Structures
Steel tonnage: 4,850t

The UK's distribution centre sector is on the up with a raft of projects currently in the offing or under construction.

One of the largest jobs under way in this buoyant marketplace is a new distribution centre and offices for Next. Occupying a footprint of 58,000m², this huge structure is under construction at IDI Gazeley's 115-acre G.Park in Doncaster.

As with the majority of distribution centres, the Next facility is a steel-framed multi-span portal frame measuring up to 380m in length and with spans of up to 37m. One end of the structure features an attached five-storey office block built around precast lift cores.

A steel solution for the construction of this large distribution centre was the preferred option for a number of reasons, most notably the speed of construction, the long span qualities needed and cost efficiency.

"The client wanted this bespoke building to look modern, clean and attractive. It needed to meet the demands of the current business with a view to future flexibility and expansion," explains SiCa Partner Simon Noblet.

"The building design has evolved from, and is subservient to, the sophisticated materials handling equipment within. It is also hoped that this new warehouse will be a pleasant place to work in with first-class facilities for both warehouse and office staff."

The steel frame's columns are set at 8m intervals, which correspond with the internal racking system's geometry. Likewise the portal spans have also been designed with the building's internal functions in mind.

Four of the portal frame spans are 29.3m, but along one elevation there is a 37m span, which has been designed to accommodate a large multi-storey mezzanine structure.

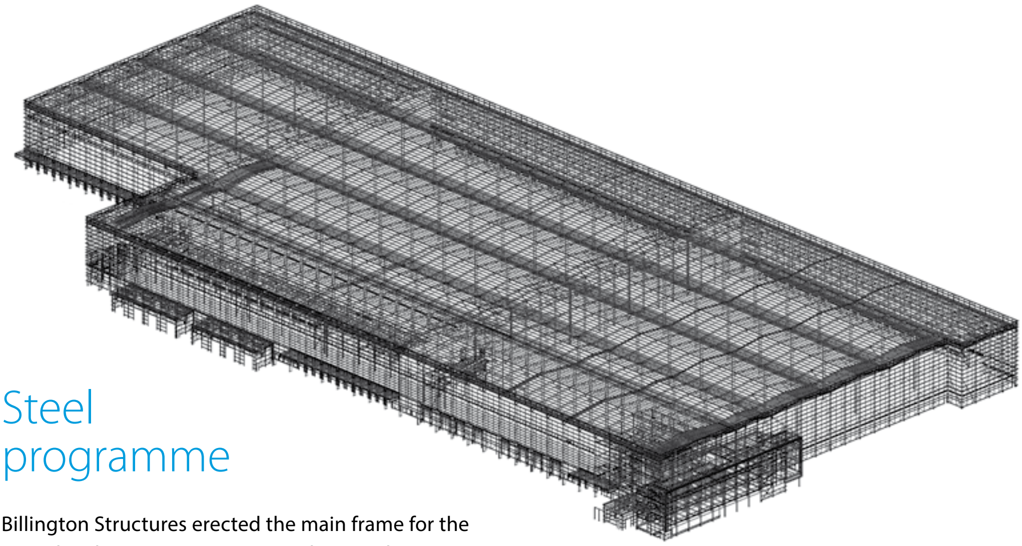
This wider 37m span will also accommodate the facility's bespoke docking system where truck's trailers are disconnected outside the building and then automatically transported inside for loading.

Between the 37m span and the first of the four 29.3m portals there is one narrower 18m wide portal. This portal was made smaller because of the project's footprint constraints.

Concept design for the project was by Adept Consulting Engineers, however detailed design of the complex steelwork was carried out by Billington Structures.

"We've also designed flexibility into the steel frame," explains Adept Consulting Engineers Project Manager Erol Erturan. "The mezzanines have been erected as a two-storey structure, but a third level, if required, can be accommodated in the future as the distribution centre has a 21m height to the underside of the haunch."

The huge distribution centre takes shape



Steel programme

Billington Structures erected the main frame for the Next distribution centre in 14 weeks. In order to not clash with the site's other trades, the company then erected the mezzanine floors on a return visit later in the programme.

Prior to the steel erection starting, Billington had already begun its onsite preparation work and had started stockpiling steelwork.

"The columns are 25m long and up to 9t each, so we could only transport them on a truck to site two at a time," explains Billington Structures Contracts Director Brian Turton.

"That's why it's important to have steel deliveries carefully co-ordinated and steel stockpiled on site in the respective working areas… to ensure that we could give continuity for the erection teams on site."

The portal rafters were brought to site in two sections and then erected in pairs. Using two mobile cranes, the rafters were lifted into place, bolted to their respective columns and then bolted together at midpoint before being released from the cranes.

Stability bracing will also render the internal mezzanine floors independent of the main building, enabling them to accommodate a complex system of tracks for an automated handling system.

The structural design includes the overall building being split into five separate independently stable zones by party walls, which will ensure that the warehouse remains operational in the event of a fire in one of the compartments.

The compartments are not all the same size and the two largest are five spans wide and accommodate the Centre's high bay racking system, which will be serviced by robotic cranes.

The project also includes a conveyor link bridge from the north eastern corner of the building to transfer stock to the existing Next warehouse, across Holme Wood Lane.

The bridge will be a four span 120m-long structure formed with a series of trusses to accommodate the double deck configuration. The lower deck will feature conveyor belts for transporting goods, while the upper deck will be a pedestrian thoroughfare for the workers.

The 40-acre site will accommodate 394 car parking spaces, including 21 disabled spaces, which are to be located on the western part of the site. Twenty five covered parking spaces will also be provided, while 48 HGV parking spaces are to be provided to the northern side of the building within the dispatch yard, together with 15 trailer box parking spaces and 55 loading bays.

Billington CEO Mark Smith, said: "The construction of a distribution warehouse on such a large scale involves a great deal of complex planning.

"The fact that Bowmer & Kirkland has once again chosen Billington Structures to provide the structural steelwork for one of their most significant and prestigious projects, and indeed clients in Next, is testament to Billington's quality, reliability and performance."

Summing up the project Bowmer & Kirkland Project Manager Ben Howard says: "Erection of a 25m high distribution facility, with ancillary offices and building services, doesn't come without its own challenges.

"Early access dates and a tight overall schedule dictate a correctly sequenced approach by ourselves, which guarantees a defined outcome for our client.

"Utilising specialist contractors in their own fields early on is essential for the co-ordination of design, erection sequencing and programming alongside interfacing elements. This gives us the best opportunity for a achieving our project goals."

The Next distribution centre is due to be complete by early 2016.

Columns are up to 25m high

"The client wanted this bespoke building to look modern, clean and attractive. It needed to meet the demands of the current business with a view to future flexibility and expansion."

Coordination between steel deliveries and the erection has been key

Circus feat

The building maximises the available space

A new commercial development on Finsbury Circus in the City of London has thrown-up a number of unique challenges, reports Martin Cooper.

Overlooking the City of London's largest open public space, a new prestigious nine-storey office building is rapidly taking shape with the aid of steel construction's speed of delivery.

Number 8 Finsbury Circus is on a plot previously occupied by River Plate House, which was demolished in 2013 to make way for this scheme. Built in the 1980s, the old building was deemed to be inefficient by today's standards. With a large central atrium and off-centre core, little thought seems to have been given to maximising floor plates.

This is not the case with the new scheme, as it will offer 14,800m^2 of offices and 880m^2 of retail space. The development also accommodates two main entrances, one on Finsbury Circus and the other on South Place, which will be set within a retained 1920s façade.

With the exception of the retained façade, the creation of a new building was seen as the best way to give the client the modern office building required.

"After an in-depth appraisal of the site, it was decided that a completely new build as opposed to a renovation was the best way forward. This has allowed us to design a light-filled modern office that is sympathetic to its neighbouring buildings on the Circus," explains Wilkinson Eyre Project Architect Sam Wright.

A steel framing solution with a centrally positioned core was then deemed to be the best way of achieving this design. A lightwell that adjoins one of the three party walls allows light to penetrate the structure's upper floors where the building is at its deepest.

A nine-storey high metal artwork by renowned design studio Carpenter/Lowings will be hung in the lightwell when the project is nearing completion. The artwork will act as a reflector and help spread light into the floors below.

"The new structure incorporates a long-span steel frame and composite floors utilising one concrete core for stability," explains Waterman Group Project Engineer Richard Whitehead. "We have a very efficient building that maximises the available space.

"The design choice has also made the construction programme much quicker as steel erection and basement works have been able to progress simultaneously."

A modern structure has been seamlessly set into Finsbury Circus

Minimising the amount of time a project team spends on site is important and so are logistics. Any construction project in the City of London has to negotiate a raft of logistical challenges, ranging from traffic and access issues, through to noise and how to minimise it and keep the neighbours happy.

This project is no different as Lend Lease Project Director John Chesters explains: "We have a seven day a week programme, which means there are a number of periods when noise must be kept to a minimum to satisfy the neighbouring buildings that include a prestigious City hotel."

The challenge of bringing materials to site, never an easy task at the best of times in the City, has been compounded by the fact that the Crossrail project team has occupied the centre of Finsbury Circus.

As they are excavating a major tunnel portal and have temporary offices in the Circus, Crossrail has precedence when it comes to traffic and this has meant that the majority of steel deliveries have had to be made via South Place.

"The delivery zone is opposite the hotel so we have to be as quiet as possible with our steel deliveries which are usually made early in the morning," says William Hare Project Director Pat Egan.

The only exceptions to this delivery procedure have been the longest beams, which are up to 16.5m long. These sections are too big and too heavy to be unloaded at South Place and consequently special arrangements are made with the Crossrail team to allow them to be unloaded on Finsbury Circus.

"The structure's longest spans are also along the Finsbury Circus elevation and so it makes logistical sense to deliver these beams in a way that negates lifting them over the entire structure," adds Mr Egan.

William Hare began erecting steelwork earlier this year, once the centrally positioned and stability giving concrete core had been completed.

The structural steel frame begins in the two-storey deep basement. This area has been enlarged, as the basement area inherited from the previous building was not deep enough for the new structure that incorporates plant equipment on the lowest level and offices and retail on the lower ground level (basement).

The lower ground and ground floor slabs are constructed from insitu concrete, while from first floor upwards construction is a steel composite design with steel beams supporting a reinforced concrete slab cast on metal decking.

The ground floor concrete slab supports a service yard, and was cast in place early in the programme and this then allowed the team to carry on with the basement works below, while the steel frame was being erected above.

Using a variety of access platforms in conjunction with the site's tower crane, the steel frame has required more than 2,600 individual crane lifts.

This high number of lifts correlates to the high piece count of steel members, which is necessary because of the shape and complexity of the structure.

To maximise the project footprint the structure is pentagonal-shaped, with an arced frontage along Finsbury Circus in keeping with the surrounding architecture. Because of this shape, the internal spans vary considerably, from 8m right up to 16.5m at the front.

Fabricated cellular beams have been used throughout to integrate the services and to help minimise the structural floor zone which in turn has helped fit-in the required number of floors without exceeding the height restriction.

As well as the complex shape, the steel frame's design also incorporates three column changes on the first, fifth and eighth floors. On the two upper levels transfer structures have been inserted to accommodate steps in the Finsbury Circus elevation that accommodate outdoor terraces, while on the ground floor, another transfer structure helps make the entrance foyer larger.

Floors seven and eight also feature raking outer columns along their main elevations forming a mansard that helps the building to adhere to the rights-to-light requirements.

Another area of the building that has had to incorporate a column line change is the South Place elevation. On this part of the project, in order to prevent new steel columns clashing with the retained façade's windows, column positions have been moved accordingly.

Interestingly, Lend Lease has meticulously removed the retained façade, that originally extending along most of the South Place elevation. Each Portland Stone block has been temporarily removed and stored safely offsite.

"It was decided that removing the four-storey high façade and then rebuilding it after the steel frame was complete was a safer and more efficient option than propping it up during the construction programme," says Mr Chesters.

8 Finsbury Circus is due for completion in the first quarter of 2016.

FACT FILE
8 Finsbury Circus, London
Main client:
Stanhope
Architect:
Wilkinson Eyre
Main contractor:
Lend Lease
Structural engineer:
Waterman Group
Steelwork contractor:
William Hare
Steel tonnage:
2,000t

Mansards on the building's upper floors help the structure adhere to rights-to-light requirements

Excellent Monument

Aiming to achieve a BREEAM 'Excellent' rating, The Monument Building will provide high quality office space in the heart of the City. Martin Cooper reports

FACT FILE
The Monument Building, London
Main client: Skanska
Architect: Make Architects
Main contractor: Skanska
Structural engineer: Arup
Steelwork contractor: Severfield
Steel tonnage: 650t

Steel programme benefits from cooperation

A new Grade A office development has quickly taken shape adjacent to one of the capital's most famous landmarks – the Monument, which was erected to commemorate the Great Fire of London.

Taking the plot formerly occupied by three buildings that were demolished last year, the new structure will offer approximately 8,000m² office space and a further 460m² of ground floor retail accommodation.

All of the upper floors of this nine-storey structure will accommodate offices, some of which - floors four, five, seven and nine – feature outdoor terraces.

Structurally, the building has been designed with a steel frame based around one eccentrically positioned concrete core. Below ground level the structure is founded on concrete raft foundations, while a basement and ground slab have also been formed with concrete.

Most of the building is built around a grid pattern offering spans of up to 12m. The spans vary slightly because although The Monument Building is roughly square-shaped in plan to fill up the entire footprint of the plot, the western side of the structure does offer longer spans.

"So we could minimise the structural floor zone, and hence maximise the number of floors, a steel-framed option was the best solution for this project," says Arup Senior Engineer Michael Heywood. "Cellular beams have been used throughout to accommodate services and in this way we've been able to get a nine-storey structure on a site with strict planning height restrictions adjacent to the historic Monument."

Steelwork contractor Severfield has fabricated, supplied and erected (see box) 650t of structural steel for the project.

Utilising a coordinated multidisciplinary Building Information Modelling (BIM) approach, the project team was able to streamline the design, which in turn helped optimise the steel tonnage to its most efficient amount.

"We always propose that all subcontractors use BIM on our projects as it not only optimises the design but it's also beneficial as it eliminates any clashes and speeds up the programme," says Skanska Project Director Brian Nunn.

Speed of programme is always of importance on any site and, to this end, Skanska decided to install the precast stairs inside of the building's slip-formed core immediately after it was completed.

Having done this work before the steel programme kicked off meant once Severfield did commence work, safe access to the upper floors was already in place, which meant no temporary stairs needed to be installed. Utilising the project's one tower crane and a

The steel erection programme was completed in July, ahead of its planned 20 weeks schedule.

Severfield Project Manager Robin Hamill puts this down to the close coordination his company had with Skanska and the other trades, which ensured the steel erection and metal decking installation was carried out as efficiently as possible.

"We sat down and started planning the project with Skanska 18 months in advance of steel erection starting," he explains.

Most inner city sites pose logistical challenges when it comes to deliveries. The Monument Building is no different as it is slap bang in the middle of the City of London and bounded by two narrow, but busy streets on two sides and a public square along its main façade.

Skanska had been able to get a partial road closure on one of the adjacent streets, which allowed the team to create a delivery and offloading zone, albeit opposite Monument Underground station.

All steel deliveries were coordinated and had to be unloaded from 7am onwards when the road closure was in place. Unfortunately, this timing also coincided with the morning rush hour and the team had to deal with the thousands of commuters that regularly exit the station.

"We had to ensure the steelwork was quickly and safely unloaded from the trucks and then placed on our laydown areas which had to be within the building's footprint – in other words on top of the erected frame," explains Mr Hamill.

The new building is adjacent to one of London's most famous landmarks

The completed building

Unloading steel outside of Monument station

Cellular beams have been used throughout

Model showing the steel frame

combination of access machines, Severfield erected ground floor to level 3 in one sequence and from then on installed two floors at a time.

With the metal decking being installed a couple of levels behind the steel erection, the programme ensured, for safety reasons, that there were always at least two completed floors in between steel going up and the other follow-on trades.

"The steel erection was sub-divided into four phases for each floor, starting in the south east corner and erectors then working around the core in a clockwise direction," says Skanska Senior Site Engineer Andy Flynn.

"Once steel was unloaded from the delivery trucks it was stacked on laydown points, which corresponded with the four phases on top of the completed frame."

Aside from the terraces, formed where the building steps back along its northern elevation, the frame is fairly regimented in design all the way from ground floor to roof level.

The only exception is a pair of storey-high cantilever trusses along the same northern elevation, which ensure that the building does not load an adjoining party wall by transferring the perimeter column loads inwards.

The party wall belongs to the only building that adjoins The Monument Building's plot and crucially sits atop the Circle and District underground lines, which are just below street level.

"We selected steel for its light structure, which came in handy on the more complex areas of the development where we were close to the underground system. Also known for being an efficient material with sustainable qualities, it was an appropriate choice for the design of The Monument Building," says Make Architects Partner Cara Bamford.

Although this neighbouring building is adjacent to the new structure, both are independent, apart from the fact that the old building's outdoor fire escape has had to be removed during the construction programme and will be re-installed later. It will then incorporate a ground floor escape corridor within The Monument Building's footprint.

"Because of the building's cascading terraces along this elevation, the cantilever trusses support only four storeys as opposed to the nine across the rest of the building," says Mr Heywood. "This means we've been able to achieve an efficient design that works with both the architecture and building services."

The Monument Building is scheduled to be complete by May 2016.

Steel spearheads docks regeneration

FACT FILE
Tower Wharf, Birkenhead
Main client: Longmeadow Estates
Architect: Falconer Chester Hall
Main contractor: Eric Wright Construction
Structural engineer: Muir Associates UK
Steelwork contractor: Leach Structural Steelwork
Steel tonnage: 375t

An £11M flagship steel-framed office development - one of the initial phases of Birkenhead's Wirral Waters regeneration scheme – will be completed shortly.

Birkenhead's once thriving docks are to be given a makeover

Wirral Waters is said to be the largest regeneration project in the UK and will eventually transform more than 500 acres of Birkenhead's former docks into a new business and leisure destination.

Developer Longmeadow Estates says it is also set to become one of the most sustainable enterprise zones in the country as well as an exciting place to live, work and spend time.

Design plans envisage an area that is not over reliant on the car and to achieve this aim the construction of a tram network to link into the existing Merseyrail system has been mooted.

At its heart, the project seeks to use the unique water assets of the city to drive growth across all sectors; for trade, for jobs, for energy, for transport and for leisure.

Creating new employment is one of the key drivers and Wirral Waters could create as many as 20,000 jobs in the coming years, by encouraging firms to relocate to its new and modern premises.

One of the scheme's first office developments is known as Tower Wharf. It is a four-storey building aiming for a BREEAM 'Excellent' rating and will offer 4,450m² of flexible Grade A open plan office space.

The steel frame nears completion

The building includes a top floor roof terrace affording views over the adjacent former dockside waterfront and the extensive landscaping that will eventually surround the structure.

"This project will deliver much needed accommodation and employment opportunities for a scheme which will boost business and generate investment into the area," explains Eric Wright Construction Operations Director Jonathon Rayner.

Working on behalf of the main contractor Eric Wright Construction, Leach Structural Steelwork has fabricated, supplied and erected 375t of steel for Tower Wharf.

Using one 35t-capacity mobile crane for the entire steel erection programme, Leach also installed 6,000m² of metal decking and two precast staircases during its eight-week onsite programme.

"A steel construction solution was chosen for this building as it was the most economical," explains Muir Associates Director Mark Jones.

The steel frame is founded on piled foundations and has been designed and erected around an irregular grid pattern to suit the architect's layout. However, the majority of the grid is based around columns set at 7.5m centres, which suits the curtain walling mullions across the building.

The structure is approximately 98m long × 16.5m wide and internally it has a predominantly open plan design, while externally it will be fully clad with glass.

According to project architect Falconer Chester Hall, the structure references the materials and proportions of the surrounding buildings, with its recessed ground floor and the stepped back roof profile creating a shape reminiscent of the trade vessels that once would have stood in the nearby docks.

"A steel construction solution was chosen for this building as it was the most economical."

Structural stability is achieved by the use of moment frames, and bracing located in lift and stair cores.

Additional stability is derived from feature architectural Macalloy cross bracing that has been installed at both end elevations. This will remain visible within the completed scheme, while internally further Macalloy bracing, around staircases, will also be left exposed.

Summing up, Cllr Phil Davies, Leader, Wirral Council, said: "This is of huge importance, given that it kick starts the regeneration of Wirral Waters.

"It is a significant step in our vision to regenerate Wirral, and demonstrates that even at a time of such economic difficulties we continue to make significant progress towards the delivery of our ambitious investment strategy. The challenge for us now is to ensure this exciting vision delivers real benefits for residents and businesses of Wirral and the Liverpool City region."

Bracing provides most of the structural stability

The steel frame is supported on piled foundations

Round Bar Cross Bracing

Dr Richard Henderson of the SCI discusses the use of round bar cross bracing in the end elevations of Tower Wharf.

Tower Wharf has a narrow rectangular footprint with the long edges stepped out at first floor level on both sides of the building. The cantilevers at the ends of the transverse frames mean that moment frames are a logical choice to provide lateral stability in the building in the transverse direction and each frame contributes. However, at the ends of the building, the first floor steps out in both directions and the columns above first floor in the end frames do not extend to the ground. There is therefore no opportunity to use a moment frame for transverse stability in these locations.

Diagonal bracing is the logical alternative and is placed in the end elevation above first floor level. The horizontal shear is transferred through the first floor diaphragm to the line of the inset columns from ground to first floor and then to the ground through bracing in this vertical plane. The full height glazing in the end elevations allows clear views into the building and displays the cross bracing clearly. A simple and complete solution is provided by the Macalloy system which includes rods, clevis-type terminal connectors, turnbuckles for tensioning and a connecting ring for the central node. Stainless steel material was initially proposed but painted carbon steel was adopted instead for economic reasons.

Macalloy bars have high tensile strength, so a bar of small cross-section will carry the bracing loads. This means that a bracing panel potentially has relatively low shear stiffness (compared for example with tension/compression bracing which is designed for flexural buckling) because the stiffness depends on the area of cross-section of the bar. By tensioning the bracing, both diagonals contribute to the shear stiffness of the panel (which would clearly not be so if the compression diagonal went slack). The distributed lateral stability system in the building means that the lateral stiffness of the braced panel is similar to the stiffness of an individual moment frame. In a building where the lateral stability system was concentrated into a small number of braced bays, rod bracing would not be sufficiently stiff to provide an effective solution.

As an illustration, the shear deflection of a hypothetical 3.5 m square braced panel transferring 35 kN, consisting of 203UKC46 columns and a 305 × 127UKB37 beam with different bracing systems is compared in the table.

Bracing Elements	Area (cm²)	Shear deflection of panel (mm)
76.1 x 5 CHS (tension/compression, strength design)	11.2	1.47
11 mm rod (tension-only, strength design)	0.95	17.4
20 mm rod (tension-only)	3.14	5.25
20 mm rod (post-tensioned)	3.14	2.66

Eurocode revision

British Standards Institution (BSI) has published a revised Eurocode 3: *Design of steel structures* as well as a revised National Annex.

BS EN 1090-2 *Execution of steel structures and aluminium structures: Technical requirements for steel structures* introduced the concept of execution class as an aid to designers when specifying the execution requirements for steel structures.

British Constructional Steelwork Association (BCSA) Director of Engineering Dr David Moore said: 'It was recognised by the European committee responsible for BS EN 1090-2 that it would be more appropriate for such guidance to be given in the design standard for steel structures, BS EN 1993-1-1 and hence a revision to this standard was developed."

Guidance on the selection of Execution Class has now been included in a new normative Annex C to BS EN 1993-1-1. Annex C links Execution class to the Consequences Class/Reliability Class of the structure and the type of loading (static, quasi-static, fatigue and seismic actions). It also includes restrictions on the use of Execution Class 1. Guidance on both of these recommendations is subject to National Determination and the UK has published an amendment to the National Annex to BS EN 1993-1-1 which replaces the guidance given in Table C.1 – Choice of execution class (EXC) and the restrictions on execution class 1 given in clause C.2.2(4) of Annex C of BS EN 1993-1-1.

The National Annex replaces Table C.1 of BS EN 1993-1-1:2005+A1:2014 with an alternative table that links Execution Class to Consequences Class/Reliability Class, the sensitivity of the structure to fatigue , the grade of steel and seismic actions. This table is limited to structures designed according to the BS EN 1993 and other appropriate Eurocodes. The National Annex does not give any limitation on the use of Execution Class 1 but states that its use is not endorsed for general use.

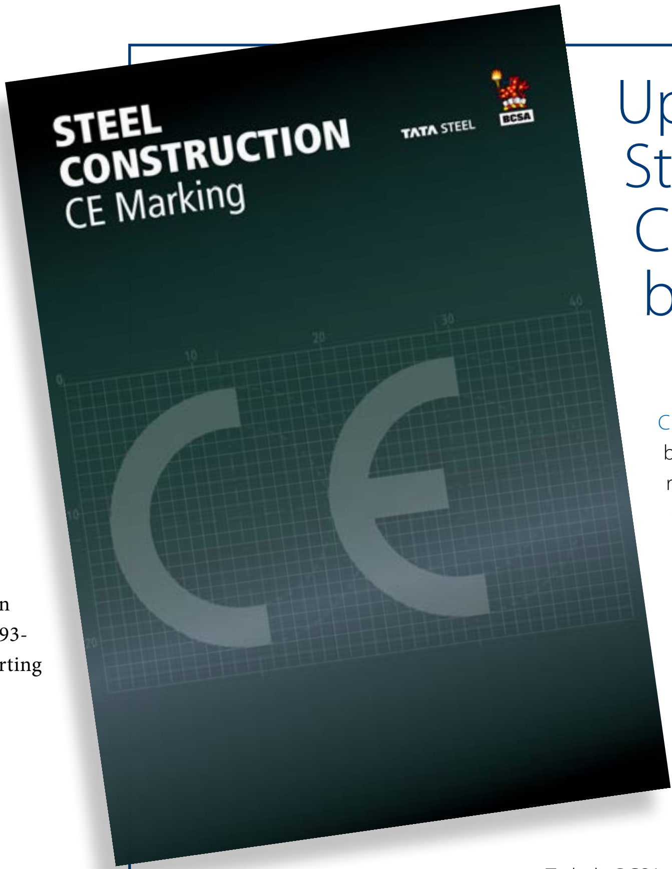
Dr. Moore said that while each structure needs to be considered on its own merits Execution Class 2 will be appropriate for the majority of buildings.

BS EN 1993-1-1:2005+A1:2014 replaces BS EN 1993-1-1:2005 which has been withdrawn. Similarly the National Annex to BS EN 1993-1-1:2005+A1:2014 replaces the National Annex to BS EN 1993-1-1:2005 which has also been withdrawn.

Although BS EN 1090-2 remains current the guidance on the selection of Execution Class is given in an informative annex [i.e. supplements normative material by offering advice, information and guidance].

The requirements given in the revised BS EN 1993-1-1 is given in a normative annex [i.e. is essential to the application of the standard]. The BCSA therefore recommends that for new projects the selection of Execution Class should be based on the recommendations given in normative Annex C of BS EN 1993-1-1:2005+A1:2014 and its supporting National Annex.

Copies of both BS EN 1993-1-1:2005+A1:2014 and its National Annex are available from BSI publications at: www.bsigroup.com/shop or alternatively BCSA members can purchase them, with a 10% discount. from the BCSA by contacting: don.thornicroft@steelconstruction.org



Updated Steel Construction CE Marking brochure

CE Marking of fabricated structural steelwork has been mandatory since 1 July 2014. It is also a legal requirement for all fabricated structural steelwork delivered to site to be CE Marked. To comply with the regulations, only steelwork contractors with an Execution Class equal to that required for a project should be considered.

Contracts for fabricated structural steelwork for buildings should include the NSSS for Building Construction 5th Edition CE Marking Version. This specification incorporates the obligations of the CPR and CE Marking on the steelwork contractor.

To help BCSA members understand their obligations, the *Steel Construction CE Marking* brochure has been revised and updated to fully incorporate all of the recent changes. The brochure is available free at www.steelconstruction.info/Steel_construction_news#Steel_construction_.E2.80.93_CE_Marking

The engineer's responsibility for CE Marking

Consequences Class

Table 11 Approved Document A

Execution Class

Table NA.4 National Annex to BS EN 1993-1-1: 2005+A1:2014

The engineer is responsible for specifying the Execution Class for the structure as a whole, the components and the details that they have designed.

Procedure for specification of Execution Class for a building:

1. Determine Consequences Class – Table 11 of Approved Document A *[Usually 2a or 2b]*
2. Select Execution Class – Table NA.4 of the National Annex to BS EN 1993-1-1:2005+A1:2014 *[Will typically result in EXC2]*

Whilst each building needs to be considered on its own merits, EXC2 will be appropriate for the majority of buildings constructed in the UK.

If the Consequences Class is not specified clause NA.2.27.2 of the National Annex to BS EN 1993-1-1:2005 +A1:2014 states that it should be assumed that the design rules in BS EN 1993 are safe for Consequences Classes up to and including CC2.

High Strength Steel

Nancy Baddoo and David Brown of the Steel Construction Institute discuss the design of high strength steel in accordance with BS EN 1993.

Introduction

There appears to be a gradual trend towards the use of higher strength steel. 20 Years ago, S275 was the norm, and S355 the exception. Now, S355 is the norm, and higher strength steels are available. The use of higher strength steels is facilitated in the Eurocodes, with strengths up to S460 covered in BS EN 1993-1-1 and even higher strengths, up to S700 covered by supplementary rules in BS EN 1993-1-12. As a further indication of emerging trends, it is likely that when BS EN 1993-1-1 is revised, the scope will be increased to cover steels up to S700, with even higher strengths, up to S960, covered in BS EN 1993-1-12.

Table 1 summarises the steel grades and quality covered in the Standards generally cited for building steelwork.

Standard		Steel Grade	Steel Quality
EN 10025-2	Non-alloy structural steels	S275, S355	JR, J0, J2, K2
EN 10025-3	Normalized/normalized rolled weldable fine grain structural steels	S275, S355, S420, S460	N, NL
EN 10025-4	Thermomechanical rolled weldable fine grain structural steels	S275, S355, S420, S460	M, ML
EN 10025-6	Flat products of high yield strength structural steels in the quenched and tempered condition	S460, 500, 550, 620, 690, 890, 960	Q, QL, QL1
EN 10210-1 *	Hot finished structural hollow sections of non-alloy and fine grain steel	Non alloy S275, S355	JRH, J0H, J2H, K2H
		Fine grain S275, 355, 420, 460	NH, NLH,
EN 10219	Cold formed welded structural hollow sections of non-alloy and fine grain steels	Non alloy S275, S355	JRH, J0H, J2H, K2H
		Fine grain S275, 355, 420, 460	NH, NLH
* The next revision of EN 10210 will include steels up to S960.			

Table1: European material specifications for steel

Steel properties like strength and toughness depend both on the chemical composition and processing procedures; steel producers use a wide range of methods to achieve the required balance of properties. Although the easiest way to improve the strength of steel is to increase its carbon content, this reduces other important properties like weldability, toughness and formability. Microalloying with elements like niobium, vanadium or titanium in amounts below 0.1 wt % (1000 grams/tonne) is a cost-effective method of achieving a balanced combination of properties.

Design using high strength steels

Figure 1 demonstrates the changing stress-strain behaviour with increasing steel strength. As the strength increases, the ratio of ultimate to yield strength reduces, and the ductility also reduces, although the reduction is not significant enough to affect the design of the majority of structures. Due to these differences in stress-strain characteristics, a few design rules require modification for the higher strength steels.

BS EN 1993-1-12 relaxes the minimum required ratio of the ultimate tensile strength to the yield strength (f_u/f_y) to 1.05 (compared to 1.1 for conventional strength steels) and the elongation at failure is only required to exceed 10% (compared to 15% for conventional strength steels). However, as a result of these restrictions, plastic analysis and semi-rigid joints are not permitted.

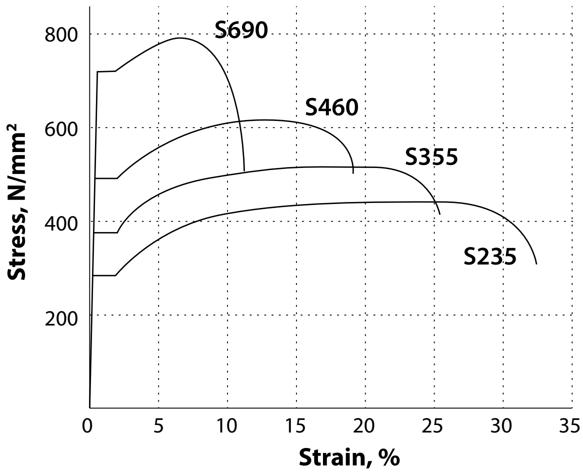


Figure 1: Stress strain characteristics of high strength steels

Steel strength

For higher strength steels, the 'design strength' does not follow the familiar pattern of a 10 N/mm² reduction at each 'step' in material thickness. The product Standard must be carefully considered when using steels above S355. Table 2 shows the steel strengths for S460.

Thickness (mm)	≤ 16	> 16 ≤ 40	> 40 ≤ 63	> 63 ≤ 80	> 80 ≤ 100
f_y (N/mm²)	460	440	430	410	400

Table 2: Steel strengths from EN 10025-4 for S460

Member classification

As the yield strength increases, members may move into a higher (more onerous) class. In Table 5.2 of BS EN 1993-1-1, the classification limits are based on ε, which itself is based on the yield strength of the steel.

$\varepsilon = \sqrt{\dfrac{235}{f_y}}$, so as f_y increases, each limit, based on ε, will decrease.

Flexural Buckling

As the steel strength increases, members are less sensitive to imperfections and the residual stresses - they are a smaller proportion of the design strength. This is reflected in BS EN 1993-1-1, where a higher flexural buckling curve is permitted for most section shapes in S460. Notably, there is no improvement for cold formed hollow sections, channels and angles. For hot-rolled sections, the improvement can be significant, in addition to the increase in strength.

A second effect is that slenderness is increased, as the yield strength increases, but this is much less significant than the increase in strength combined with the improved buckling curve.

The increase in resistance is more pronounced at low to medium slenderness. At high slenderness, the improvement is modest, as can be seen in Figure 2.

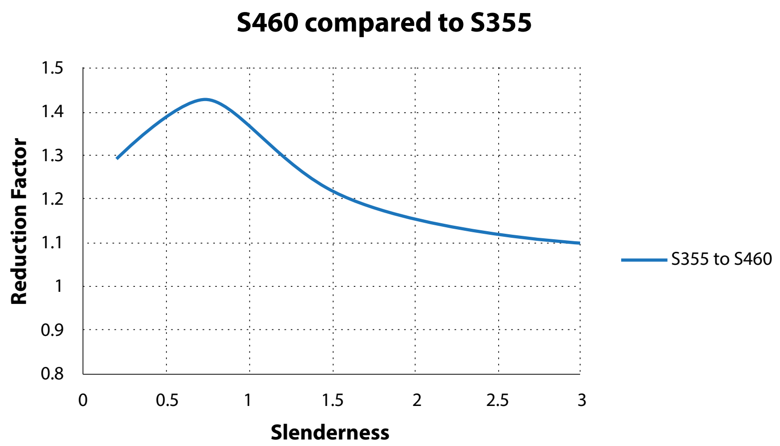


Figure 2 Comparative flexural resistance between S355 and S460 – minor axis

Two examples are shown below to illustrate the values shown in Figure 2. Clause 6.3.1 of BS EN 1993-1-1 should be consulted.

Example 1: 305 UKC 118, 6 m length

$$N_{cr} = \frac{\pi^2 EI}{L^2} = \frac{\pi^2 \times 210000 \times 9060 \times 10^4}{6000^2} \times 10^{-3} = 5216 \text{ kN}$$

In S355, $\bar{\lambda} = \sqrt{\frac{Af_y}{N_{cr}}} = \sqrt{\frac{150 \times 10^2 \times 345}{5216 \times 10^3}} = 0.99$

Note the use of 345 N/mm² as $t_f > 16$ mm
In the minor axis, curve c is to be used, so $\alpha = 0.49$

$$\phi = 0.5\left[1 + \alpha\left(\bar{\lambda} - 0.2\right) + \bar{\lambda}^2\right] = 0.5\left[1 + 0.49\left(0.99 - 0.2\right) + 0.99^2\right] = 1.184$$

$$\chi = \frac{1}{\phi + \sqrt{\phi^2 - \bar{\lambda}^2}} = \frac{1}{1.184 + \sqrt{1.184^2 - 0.99^2}} = 0.545$$

$N_{b,Rd} = 0.545 \times 150 \times 102 \times 345 \times 10^{-3} = 2820$ kN

In S460, $\bar{\lambda} = \sqrt{\frac{Af_y}{N_{cr}}} = \sqrt{\frac{150 \times 10^2 \times 440}{5216 \times 10^3}} = 1.125$

Note the use of 440 N/mm² as $t_f > 16$ mm; design grades in S460 do not follow the usual 10 N/mm² steps.
In the minor axis, curve a is to be used, so $\alpha = 0.21$

$$\phi = 0.5\left[1 + \alpha\left(\bar{\lambda} - 0.2\right) + \bar{\lambda}^2\right] = 0.5\left[1 + 0.21\left(1.125 - 0.2\right) + 1.125^2\right] = 1.23$$

$$\chi = \frac{1}{\phi + \sqrt{\phi^2 - \bar{\lambda}^2}} = \frac{1}{1.23 + \sqrt{1.23^2 - 1.125^2}} = 0.579$$

$N_{b,Rd} = 0.579 \times 150 \times 102 \times 440 \times 10^{-3} = 3821$ kN
The resistance of the S460 column is 1.35 that of the S355 column. This corresponds to a slenderness of 1.0 in Figure 2.

Example 2: 305 UKC 118, 12 m length

$$N_{cr} = \frac{\pi^2 EI}{L^2} = \frac{\pi^2 \times 210000 \times 9060 \times 10^4}{12000^2} \times 10^{-3} = 1304 \text{ kN}$$

In S355, $\bar{\lambda} = \sqrt{\frac{150 \times 10^2 \times 345}{1304 \times 10^3}} = 1.99$

$$\phi = 0.5\left[1 + 0.49\left(1.99 - 0.2\right) + 1.99^2\right] = 2.919$$

$$\chi = \frac{1}{2.919 + \sqrt{2.919^2 - 1.99^2}} = 0.198$$

$N_{b,Rd} = 0.198 \times 150 \times 10^2 \times 345 \times 10^{-3} = 1025$ kN

In S460, $\bar{\lambda} = \sqrt{\frac{150 \times 10^2 \times 440}{1304 \times 10^3}} = 2.25$.

In the minor axis, curve a is to be used, so $\alpha = 0.21$

$$\phi = 0.5\left[1 + 0.21\left(2.25 - 0.2\right) + 2.25^2\right] = 3.247$$

$$\chi = \frac{1}{3.247 + \sqrt{3.247^2 - 2.25^2}} = 0.179$$

$N_{b,Rd} = 0.179 \times 150 \times 10^2 \times 440 \times 10^{-3} = 1181$ kN
At this higher slenderness, the improvement in resistance is 15%, illustrating the diminishing advantage shown in Figure 2 at higher slenderness.

Lateral torsional buckling

The relationship between steel strengths and lateral torsional buckling resistance is more complicated than flexural buckling, because of the influence of the shape of the bending moment diagram. As the steel strength increases, the slenderness increases, but the effect is modified by the f factor found in clause 6.3.2.3(2) of BS EN 1993-1-1. The same LTB curves are used for all steel grades.

Until the end of the plateau at a slenderness of 0.4, clearly the full increase in strength can be utilised. As slenderness increases, and buckling behaviour becomes more significant, the advantage of the increased strength diminishes.

Where to consider high strength steel...

The advantages of higher strength steels are lighter weights for similar resistance, so applications where light weight, or where smaller cross sections are required, are situations where higher strength steel may be advantageous. Higher strength steels are used in long span bridges where minimising self weight is important. Reduced self weight can also be a significant benefit in long span roof structures such as stadia and aircraft hangers.

...and where not.

Reduced section sizes mean reduced second moment of area, so any situation where deflection is dominating the design or where fatigue is critical will not benefit from higher strength. Similarly, decreased stiffness may increase the vibration response.

Where might steel strengths be in another 20 years?

Perhaps there is no definitive answer, but it seems likely based on the last two decades that higher strengths will be in more common use. When revised, the Eurocodes will bring some higher strength steels into the 'general rules' indicating their increased use. At present, SCI is co-ordinating a pan-European RFCS project *HILONG*, looking at new technologies to enable a greater proportion of the strength of higher strength steels to be exploited in long span truss structures. The structural performance of innovative cross-sections with greater resistance to local buckling, such as U shapes and polygonal shapes, is also being studied.

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AD 390: Lateral Torsional Buckling of channels in accordance with EN 1993-1-1

Questions have been asked about how the lateral torsional buckling resistance of a channel should be calculated and how the effect of the load position can be accommodated. This Advisory Desk Note offers guidance on the design of these sections.

Channels have only one axis of symmetry, so the immediate question concerns the calculation of M_{cr}. The 'standard' expression, given below, is generally offered for use with bi-symmetric sections, such as I and H shapes, with load applied at the shear centre.

$$M_{cr} = C_1 \frac{\pi^2 EI_z}{L^2}\sqrt{\frac{I_w}{I_z}+\frac{L^2 GI_t}{\pi^2 EI_z}}$$

In fact, this expression is also appropriate for channel sections. Although a channel is monosymmetric, the shear centre and centroid are not displaced perpendicular to the bending axis, as shown in Figure 1(a). In Figure 1(b), an asymmetric beam is shown, where the centroid is displaced with respect to the shear centre – in this case the calculation for M_{cr} would need to be modified.

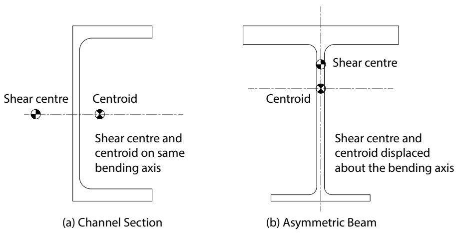


Figure 1 Channel section and asymmetric beam

In P363 (the Blue Book)[1] the 'standard' expression given above is used to calculate M_{cr}, and the lateral torsional buckling calculated using curve 'd', in accordance with Table 6.5 of the UK National Annex, where channels are covered by "All other hot rolled sections". In the Blue book, the reduction factor for lateral buckling resistance is calculated using clause 6.3.2.3.

The unsaid assumption in completing the preceding resistance calculation is that the vertical load is applied at the shear centre, as shown in Figure 2(a). If the load is applied in line with the web (Figure 2(b)), an additional torque is applied, which must be allowed for. The Eurocode is silent on how this should be accommodated.

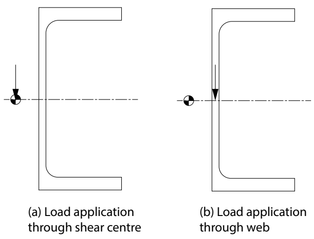


Figure 2 Point of load application

Several European researchers have looked at this problem. SCI recommend Snijder *et al*[2] who provide a recommendation for dealing with this issue in accordance with the Eurocodes. The research investigated several possible solutions and compared the results to an extensive set of non-linear analyses of members.

The recommendation from Snijder *et al* applies to all positions of eccentric load application between the shear centre and the web. The recommended approach is to modify the slenderness of the section with an adjustment for torsion. Then, the approach uses the "general case" expression of clause 6.3.2.2, but with buckling curve 'a'. This curve has been selected because it gives a good fit for the numerical results.

The rather strange observation when comparing the resistances in the Blue Book with the resistances calculated following the recommendations of Snijder *et al* is that the calculated resistances are almost the same. The 'advantage' of the 6.3.2.3 expression, combined with the 'penalty' of curve 'd' used in the Blue Book is balanced by the 'penalty' of 6.3.2.2 and the 'advantage' of curve 'a' used by Snijder *et al*.

Snijder *et al* do have a maximum cut off value for $\chi_{LT} = 0.67$, but this seems to be for historic reasons rather than the evidence of the results. For the present, SCI see no reason to provide more details of the Snijder *et al* approach, or to provide additional resistances in the Blue Book for channels with vertical loads applied at the web. By strange coincidence, it appears that the resistances in the Blue Book are adequate for all vertical load application lines between the shear centre and the web.

1 SCI P363 Steel Building Design: Design Data (Updated 2013)

2 Snijder, H. H; Hoenderkamp, J. C, D; Bakker, M. C. M; Steenbergen, H. M. G. M and de Louw, C. H. M. Design rules for lateral torsional buckling of channel sections subject to web loading. Stahlbau, Volumn 77, Issue 4, Pages 247-256, April 2008

Contact: **David Brown**
Tel: **01344 636525**
Email: **advisory@steel-sci.com**

New and revised codes & standards

From BSI Update August 2015

BS EN PUBLICATIONS

BS EN 13381-9:2015
Test methods for determining the contribution to the fire resistance of structural members. Applied fire protection systems to steel beams with web openings
No current standard is superseded

CORRIGENDA TO BRITISH STANDARDS

BS EN 1993-1-1:2005+A1:2014
Eurocode 3. Design of steel structures. General rules and rules for buildings
AMENDMENT 1

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT – ADOPTIONS

15/30303377 DC
BS EN ISO 17635 Non-destructive testing of welds. General rules for metallic materials. Complementary element
Comments for the above document were required by 18 August 2015

15/30310964 DC
BS EN ISO 10675-1 Non-destructive testing of welds. Acceptance levels for radiographic testing. Steel, nickel, titanium and their alloys
Comments for the above document were required by 2 September 2015

15/30314901 DC
BS EN ISO 14343 Welding consumables. Wire electrodes, strip electrodes, wires and rods for arc welding of stainless and heat resisting steels. Classification
Comments for the above document were required by 25 August 2015

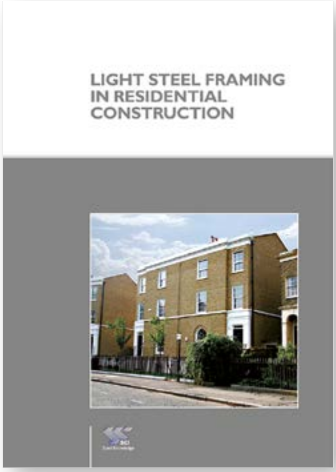
15/30320416 DC
BS EN 1090-2 Execution of steel structures and aluminium structures. Technical requirements for steel structures
Comments for the above document are required by 18 September 2015

15/30323235 DC
BS EN ISO 14171 Welding consumables. Solid wire electrodes, tubular cored electrodes and electrode/flux combinations for submerged arc welding of non-alloy and fine grain steels. Classification
Comments for the above document were required by 25 August 2015

CEN EUROPEAN STANDARDS

EN 1993-1-4:-
Eurocode 3. Design of steel structures. General rules. Supplementary rules for stainless steels.
AMENDMENT 1: June 2015
to EN 1993-1-4:2006

Light Steel Framing In Residential Construction (P402)



Catalogue number	SCI P402
ISBN Number:	978-1-85942-215-1
Author:	E Yandzio, R M Lawson, A G J Way
Pagination:	122pp
Pages:	A4
Publication date:	June 2015

Light steel framing systems use galvanized cold formed steel sections as the primary structural components, which can be assembled as prefabricated panels. Light steel framing has many advantages including reduced costs and increased speed of construction.

SCI have produced this latest publication, which updates an earlier version to reflect the latest design standards and building regulations, and current construction methods in accordance with Eurocodes and within the scope of the Building Regulations (England and Wales). Information and guidance is provided on the construction of light steel frames in general applications for residential construction, including single occupancy houses and apartments.

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Composite Construction for Crown Office Block at Hastings

FROM BUILDING WITH STEEL AUGUST 1965

This is an ambitious building plan aimed at removing 800 staff from congested London to the more salubrious air of Hastings. The project has been designed by the Ministry of Public Building and Works, through its Senior Architect, E. H. Banks, F.R.I.B.A., F.R.S.A. and Project Architect, E. B. Power, D.S.C.

The buildings have been planned on a fully industrialised basis; factory-made units are being used on a large scale and the whole of the site operations are so co-ordinated that the contract will be completed in only sixteen months. The advantages and speed of the plan were outlined by the Ministry's Directory of Works in the course of an address made to a large gathering of Architects and Consulting Engineers visiting the site at the invitation of the B.C.S.A.

In addition to five storey offices, there will be a single-storey block which will have a data preparation unit and three electronic computers, together with the attendant air conditioning plant.

The structural design and development of this project arise out of the Ministry's current efforts to encourage the use of industrialised methods in building, in all forms of construction.

The buildings are all based on an 18 ft. square grid and the five storey offices are in two interlocking hollow rectangular blocks, staggered in plan, in which each side of the rectangles is two units of 18 ft. wide. The dimensions on the outside are approximately 180 ft. × 162 ft. (10 units × 9 units) so that the enclosed glassed and paved courtyard is about 108 ft. × 90 ft. The natural slope of the ground has made it convenient to have one block and its courtyard one storey higher than the other, so that where the upper block overlaps the lower one the building becomes one of six storeys. Should a further block be constructed in the future on the eastern side, and provision is made for this, it will again be stepped up one storey, as shown in the illustration of the model. The computer block adjoins the lower office block on its western side.

Structural Design

Studies between the Ministry and the British Constructional Steelwork Association have concluded that an economic structure for office building can be obtained using a steel frame in which the concrete floors act compositely with the steel beams and by adopting lightweight dry board casings for fire protection.

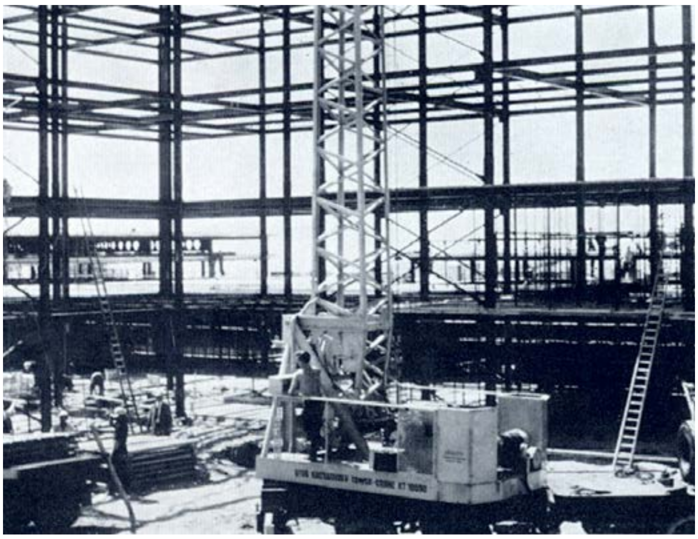
This new Crown Office building has been designed on this basis although fire protection of the beams is achieved by using a suspended ceiling which additionally facilitates re-siting of partitions, housing of services and provides a permanent finish.

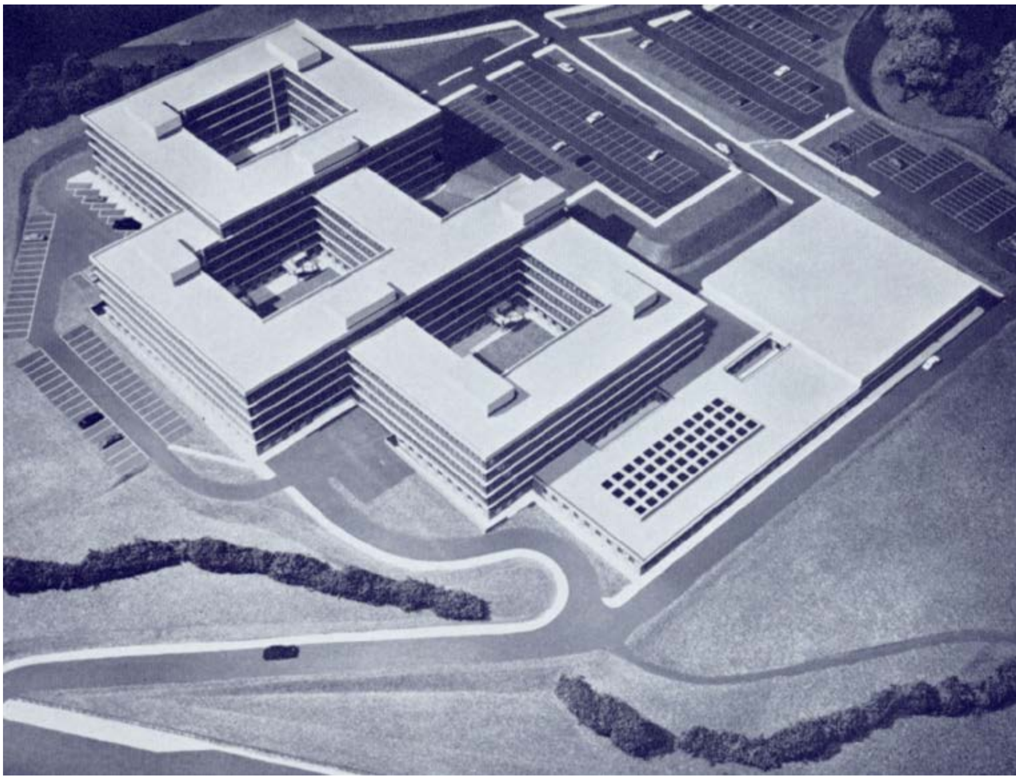
The lateral forces imposed on the structure are transmitted by the concrete floors to the r.c. walls enclosing the staircase and lift well units. The units provide the strong points through which the lateral forces are resisted and transferred to the ground.

The frame consists of steelwork arranged on the 18 ft. square grid, with intermediate floor beams at 9 ft. centres. The design is such as to keep the number of different sections, lengths and details to a minimum. Stanchions generally are of 8 in. × 8 in. UC sections varying in weight from 58 lb. per ft. to 31 lb. per ft. In a few instances these are cased in concrete where architectural or fire requirements demand this treatment. Where the top length of stanchion is a single storey height, the section is reduced to 6 in × 6 in. UC at 15.7 lb.

Stanchion bases are of four types but all have the same size holding down bolts at standard centres. The beams for the multi-storey blocks are mainly of three sections, 8 in. × 8 in. UC at 31 lb. at all perimeter positions, with 10 in. × 5¾ in. UB at 29 lb. and 7 in. × 4 in. joists at 14.5 lb internally. Intermediate 7 in. × 4 in. joists spanning between the 10 in. × 5¾ in. UBs divide the floor slabs into 9 ft. spans. Site connections are made with black bolts.

Internal beams connecting to stanchions have a shop welded top cleat and are supported





on bearing cleats welded to the stanchions. Beam-to-beam connections are made through packs on the bottom flanges of the deeper beams. The external 8 in. × 8 in. beams are bolted through their webs direct to stanchion flanges.

The single-storey computer block generally is in two sections, one of 10 ft. 6 in. storey height in which the steelwork is similar to that in the five-storey blocks and the other with its roof level 19 ft. 3 in. above the floor. In this high section, main internal beams span 54 ft. and 36 ft. and are castellated sections 36 in. and 27 in. deep respectively. Secondary roof beams are 7 in. × 4 in. joists internally and 8 in. × 8 in. UC sections around the perimeter. Additional perimeter beams (8 in. × 5¼ in. UB at 20 lb.) at low level help support the cladding.

Close integration of work between the steelwork and main contractors is achieved by the planned release of the steel framework in sections. This involves the use of temporary bracing to enable each section to be plumbed and levelled and rendered stable to enable the main contractor to follow closely behind the steelwork erectors. The temporary braces remain in position until the concrete floors have been joined to the r.c. walls of the staircase and lift blocks which provide the necessary stability against lateral forces.

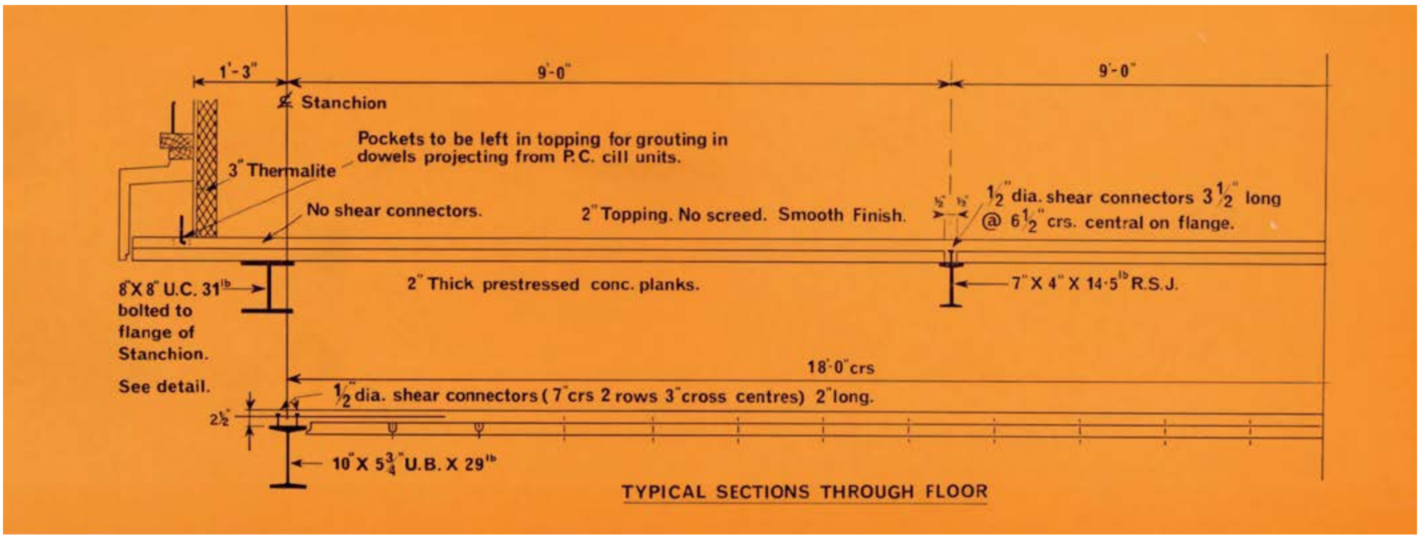
Both floors and roof are formed from 2 in. thick prestressed concrete planks with a 2 in. *in situ* reinforced concrete structural topping. The topping for the floors is given a smooth finish so that floor covering can be laid direct; no screed is required. Roof slabs are screeded to falls for drainage purposes and finished with asbestos tiles. The slabs are designed to act compositely with the beams which have ½ in. diameter stud shear connectors shop welded to the top flange. At the perimeters, both on the external face and on the side of the courtyard, the floor and roof slabs cantilever over the 8 in. × 8 in. UC beams to carry precast concrete cill and parapet units, the other faces of which are 2 ft. 3 in. beyond the 18 ft. grid line.

Staircases and lifts are generally sited at internal corners to give direct emergency access to the courtyards. The staircases are formed of hardwood treads and landings, mounted on steel plates welded to a central stringer of 8 in. × 8in. hollow section.

Cladding

The elevations, both external and courtyard, are treated in a uniform manner to afford the greatest amount of repetition of off-site fabrication.

Except for the bottom storey, the office blocks are enclosed by a screen of floor to ceiling hardwood framed window units with connecting mullions. The standard window frame width is 4 ft. 6 in. to fit in with the square grid of 18 ft. and the frames are fixed sufficiently outside the stanchion centre to permit heaters, ring mains and telephone circuits to pass behind the columns. The elevation of the bottom storeys is finished with precast exposed aggregate panels, cramped back to 9 in. concrete block walls which, being external to the steel columns, are entirely independent of the structural frame. Erection of the steelwork and building of all main structural walls and staircase blocks may thus proceed independently.



TYPICAL SECTIONS THROUGH FLOOR

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1 – Execution Class 1
2 – Execution Class 2
3 – Execution Class 3
4 – Execution Class 4

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	SCM	Guide Contract Value (1)
A & J Stead Ltd	01653 693742			●	●					●	●			●	●		2		Up to £200,000
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				●	●	●	●		●	●			●	●	✔	2	Silver	Up to £2,000,000
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AJ Engineering & Construction Services Ltd	01309 671919			●	●					●	●			●	●	✔	4		Up to £1,400,000
AKD Contracts Ltd	01322 312203				●					●	●			●	●		2		Up to £100,000
Angle Ring Company Ltd	0121 557 7241												●			✔	4		Up to £1,400,000
Apex Steel Structures Ltd	01268 660828			●	●	●	●			●	●			●			2		Up to £1,400,000
Arminhall Engineering Ltd	01799 524510	●			●	●		●		●	●			●	●	✔	2		Up to £400,000
Arromax Structures Ltd	01623 747466	●		●	●	●	●	●	●	●	●	●		●	●		2		Up to £800,000
ASA Steel Structures Ltd	01782 566366			●	●	●	●			●	●			●	●	✔	2		Up to £800,000
ASD Westok Ltd	0113 205 5270												●			✔	4		Up to £6,000,000
ASME Engineering Ltd	020 8966 7150				●	●				●	●			●	●	✔	3	Silver	Up to £1,400,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●	●	●				●			●	●	✔	2		Up to £1,400,000
Austin-Divall Fabrications Ltd	01903 721950			●	●		●	●		●	●			●	●	✔	2		Up to £800,000
B D Structures Ltd	01942 817770			●	●	●	●				●	●		●		✔	2		Up to £800,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●				✔	4		Up to £1,400,000
Barnshaw Section Benders Ltd	01902 880848												●			✔	4		Up to £1,400,000
BHC Ltd	01555 840006	●	●	●	●	●	●	●			●	●		●	●	✔	4		Above £6,000,000
Billington Structures Ltd	01226 340666		●	●	●	●	●	●	●	●	●	●		●	●	✔	4	Gold	Above £6,000,000
Border Steelwork Structures Ltd	01228 548744			●	●	●	●				●				●		2		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 £3,000,000
Builders Beams Ltd	01227 863770				●					●				●	●	✔	2		Up to £1,400,000
Cairnhill Structures Ltd	01236 449393	●			●	●	●	●	●	●				●	●	✔	4	Silver	Up to £3,000,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●		●	●	●		●	●	✔	4	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 £800,000
Coventry Construction Ltd	024 7646 4484			●	●	●	●		●	●	●			●	●	✔	2		Up to £800,000
D H Structures Ltd	01785 246269			●	●		●				●						2		Up to £100,000
Duggan Steel Ltd	00 353 29 70072		●	●	●	●	●	●			●					✔	4		Up to £4,000,000
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
EvadX Ltd	01745 336413			●	●	●	●	●	●	●	●	●				✔	3	Gold	Up to £3,000,000
Four Bay Structures Ltd	01603 758141			●	●					●	●			●	●		2		Up to £1,400,000
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●			●				●		2		Up to £2,000,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●	●	✔	2		Up to £800,000
Gregg & Patterson (Engineers) Ltd	028 9061 8131			●	●	●	●	●				●		●		✔	3		Up to £2,000,000
H Young Structures Ltd	01953 601881			●	●	●	●	●			●			●	●	✔	2	Member	Up to £2,000,000
Had Fab Ltd	01875 611711				●				●	●	●				●	✔	4		Up to £3,000,000
Hambleton Steel Ltd	01748 810598		●	●	●	●	●	●				●		●		✔	4	Silver	Up to £2,000,000

Company name | Tel | C | D | E | F | G | H | J | K | L | M | N | Q | R | S | QM | FPC | SCM | Guide Contract Value (1)

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	SCM	Guide Contract Value (1)
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				●	●									●		2		Up to £200,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●					●		●			4		Up to £6,000,000*
John Reid & Sons (Strucsteel) Ltd	01202 483333		●	●	●	●	●	●	●	●	●	●		●	●	✔	4		Up to £6,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445			●	●	●	●	●	●	●	●	●		●	●	✔	4	●	Up to £3,000,000
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●					✔	2	○	Up to £4,000,000
Legge Steel (Fabrications) Ltd	01592 205320			●	●		●		●	●	●			●	●		3		Up to £400,000
Luxtrade Ltd	01902 353182									●	●				●	✔	2		Up to £800,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●				●	✔	4		Up to £2,000,000
M J Patch Structures Ltd	01275 333431				●					●	●			●		✔	2		Up to £800,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●		2		Up to £1,400,000
Mackay Steelwork & Cladding Ltd	01862 843910			●	●		●			●	●			●	●	✔	4		Up to £800,000
Maldon Marine Ltd	01621 859000				●	●		●	●	●					●	✔	3		Up to £1,400,000
Mifflin Construction Ltd	01568 613311			●	●	●	●				●						2		Up to £3,000,000
Murphy International Ltd	00 353 45 431384	●			●		●				●				●	✔	4		Up to £1,400,000
Newbridge Engineering Ltd	01429 866722	●		●	●	●	●				●				●	✔	3		Up to £1,400,000
Nusteel Structures Ltd	01303 268112						●	●	●	●						✔	4		Up to £4,000,000
Overdale Construction Services Ltd	01656 729229			●	●		●	●			●				●		2		Up to £400,000
Painter Brothers Ltd	01432 374400								●		●			●	●	✔	2	●	Up to £6,000,000
Pencro Structural Engineering Ltd	028 9335 2886			●	●	●	●	●	●		●			●	●	✔	2		Up to £2,000,000
Peter Marshall (Steel Stairs) Ltd	0113 307 6730									●					●	✔	2		Up to £800,000*
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●	✔	2		Up to £1,400,000
R S Engineering SW Ltd	01752 844511				●					●	●			●	●	✔	2		Up to £100,000
Rippin Ltd	01383 518610			●	●	●	●	●						●	●		2		Up to £1,400,000
S H Structures Ltd	01977 681931	●					●	●	●	●	●	●				✔	4	○	Up to £2,000,000
SDM Fabrication Ltd	01354 660895	●	●	●	●	●	●				●			●	●	✔	4		Up to £1,400,000
Severfield plc	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	●	Above £6,000,000
Shaun Hodgson Engineering Ltd	01553 766499	●		●	●					●	●			●	●	✔	3		Up to £800,000
Shipley Structures Ltd	01400 251480			●	●	●	●		●	●	●			●	●		2		Up to £1,400,000
Snashall Steel Fabrications Ltd	01300 345588			●	●	●	●	●			●				●		2		Up to £1,400,000
South Durham Structures Ltd	01388 777350			●	●	●				●	●	●			●		2		Up to £800,000
Southern Fabrications (Sussex) Ltd	01243 649000				●					●	●			●	●	✔	2		Up to £800,000
Taziker Industrial Ltd	01204 468080									●				●	●	✔	3		Above £6,000,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●				●			●	●	✔	2		Up to £200,000
Traditional Structures Ltd	01922 414172			●	●	●	●	●	●		●	●		●	●	✔	2	○	Up to £2,000,000
TSI Structures Ltd	01603 720031			●	●	●	●										2		Up to £1,400,000
Tubecon	01226 345261						●	●	●	●				●	●	✔	4	●	Above £6,000,000*
W & H Steel & Roofing Systems Ltd	00 353 56 444 1855			●	●	●	●	●						●	●		4		Up to £2,000,000
W I G Engineering Ltd	01869 320515				●					●					●	✔	2		Up to £200,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✔	4		Up to £6,000,000
Westbury Park Engineering Ltd	01373 825500	●		●	●		●	●	●	●	●				●	✔	4		Up to £800,000
William Haley Engineering Ltd	01278 760591			●	●	●			●	●	●			●		✔	4	○	Up to £4,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	●	Above £6,000,000

Company name | Tel | C | D | E | F | G | H | J | K | L | M | N | Q | R | S | QM | FPC | SCM | Guide Contract Value (1)

Corporate Members

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

Company name	Tel
Balfour Beatty Utility Solutions Ltd	01332 661491
Bluefin Group	020 3040 6723
Griffiths & Armour	0151 236 5656
Highways England Company Ltd	08457 504030
Kier Construction Ltd	01767 640111
PTS (TQM) Ltd	01785 250706

Company name	Tel
Roger Pope Associates	01752 263636
Sandberg LLP	020 7565 7000
Structural & Weld Testing Services Ltd	01795 420264
SUM Ltd	0113 242 7390
Welding Quality Management Services Ltd	00 353 87 295 5335

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
AceCad Software Ltd	01332 545800		●								N/A	
Albion Sections Ltd	0121 553 1877	●									M	
Arcelor Mittal Distribution - Scunthorpe	01724 810810								●		D/I	
ASD metal services	0113 254 0711								●		D/I	
Ayrshire Metal Products (Daventry) Ltd	01327 300990	●									M	
BAPP Group Ltd	01226 383824									●	M	
Barrett Steel Services Limited	01274 682281								●		D/I	
Behringer Ltd	01296 668259					●						
BW Industries Ltd	01262 400088	●									M	
Cellbeam Ltd	01937 840600	●									M	
Cellshield Ltd	01937 840600							●			N/A	
Cleveland Steel & Tubes Ltd	01845 577789								●		M	
CMC (UK) Ltd	029 2089 5260								●		D/I	
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	
Duggan Profiles & Steel Service Centre Ltd	00 353 56 7722485	●							●		M	

Steelwork contractors for bridgeworks

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

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

FG Footbridge and sign gantries
PG Bridges made principally from plate girders
TW Bridges made principally from trusswork
BA Bridges with stiffened complex platework (eg in decks, box girders or arch boxes)
CM Cable-supported bridges (eg cable-stayed or suspension) and other major structures (eg 100 metre span)
MB Moving bridges
RF Bridge refurbishment

AS Ancilliary structures in steel associated with bridges, footbridges or sign gantries (eg grillages, purpose-made temporary works)
QM Quality management certification to ISO 9001
FPC Factory Production Control certification to BS EN 1090-1
1 – Execution Class 1 2 – Execution Class 2
3 – Execution Class 3 4 – Execution Class 4
SCM Steel Construction Sustainability Charter
(🟠 = Gold, ⚪ = Silver, 🟢 = Member)

Notes
(1) Contracts which are primarily steelwork but which may include associated works. The steelwork contract value for which a company is pre-qualified under the Scheme is intended to give guidance on the size of steelwork contract that can be undertaken; where a project lasts longer than a year, the value is the proportion of the steelwork contract to be undertaken within a 12 month period.
Where an asterisk (*) appears against any company's classification number, this indicates that the assets required for this classification level are those of the parent company.

BCSA steelwork contractor member	Tel	FG	PG	TW	BA	CM	MB	RF	AS	QM	FPC	NHSS 19A	NHSS 20	SCM	Guide Contract Value [1]
A&J Fabtech Ltd	01924 439614	●	●		●				●	✓	3				Up to £400,000
Bourne Construction Engineering Ltd	01202 746666	●	●	●				●	●	✓	4			🟠	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●	●	●	●	●	●	●	●	✓	4		✓		Up to £3,000,000
Cairnhill Structures Ltd	01236 449393	●	●	●	●			●	●	✓	4		✓	⚪	Up to £3,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	✓	4	✓	✓	🟠	Above £6,000,000*
Four-Tees Engineers Ltd	01489 885899	●	●	●	●		●	●	●	✓	3		✓	🟢	Up to £2,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445	●		●				●	●	✓	4		✓	🟠	Up to £3,000,000
Millar Callaghan Engineering Services Ltd	01294 217711	●						●	●	✓	4				Up to £800,000
Murphy International Ltd	00 353 45 431384	●	●	●					●	✓	4				Up to £1,400,000
Nusteel Structures Ltd	01303 268112	●	●	●	●	●		●	●	✓	4	✓	✓		Up to £4,000,000
S H Structures Ltd	01977 681931	●		●	●	●	●		●	✓	4		✓	⚪	Up to £2,000,000
Severfield (UK) Ltd	01204 699999	●	●	●	●	●	●	●	●	✓	4		✓	🟠	Above £6,000,000
Taziker Industrial Ltd	01204 468080	●						●	●	✓	3	✓	✓		Above £6,000,000
Non-BCSA member															
Allerton Steel Ltd	01609 774471	●	●	●	●				●	✓	4		✓		Up to £4,000,000
Centregreat Engineering Ltd	029 2046 5683	●	●	●	●		●	●	●	✓	4				Up to £400,000
Cimolai SpA	01223 836299	●	●	●	●	●	●	●	●	✓	4				Above £6,000,000
Concrete & Timber Services Ltd	01484 606416	●	●	●	●	●	●		●	✓	4			🟢	Up to £800,000
Donyal Engineering Ltd	01207 270909	●						●	●	✓	3		✓	🟢	Up to £1,400,000
Francis & Lewis International Ltd	01452 722200							●	●	✓	2		✓	🟠	Up to £2,000,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456	●	●	●	●	●		●	●	✓	3				Up to £2,000,000
IHC Engineering (UK) Ltd	01773 861734	●							●	✓	3		✓		Up to £400,000
Interserve Construction Ltd	0121 344 4888							●	●	✓	3				Above £6,000,000*
Interserve Construction Ltd	020 8311 5500	●	●	●	●		●	●	●	✓	3				Above £6,000,000*
Lanarkshire Welding Company Ltd	01698 264271	●	●	●	●	●	●	●	●	✓	4	✓		🟢	Up to £2,000,000
P C Richardson & Co (Middlesbrough) Ltd	01642 714791	●						●	●	✓	N/A				Up to £3,000,000
Total Steelwork & Fabrication Ltd	01925 234320	●						●	●	✓	3		✓		Up to £3,000,000
Victor Buyck Steel Construction	00 32 9 376 2211	●	●	●	●	●	●	●	●	✓	4			⚪	Above £6,000,000

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM
easi-edge Ltd	01777 870901							●			N/A	●
Fabsec Ltd	0845 094 2530	●									N/A	
FabTrol Systems UK Ltd	01274 590865		●								N/A	
Ficep (UK) Ltd	01942 223530					●					N/A	
FLI Structures	01452 722200	●									M	●
Forward Protective Coatings Ltd	01623 748323						●				N/A	
Goodwin Steel Castings Ltd	01782 220000	●									N/A	
Graitec UK Ltd	0844 543 8888		●								N/A	
Hadley Group Ltd	0121 555 1342	●									M	○
Hempel UK Ltd	01633 874024						●				N/A	
Highland Metals Ltd	01343 548855						●				N/A	
Hilti (GB) Ltd	0800 886100									●	M	
Hi-Span Ltd	01953 603081	●									M	○
International Paint Ltd	0191 469 6111						●				N/A	●
Jack Tighe Ltd	01302 880360						●				N/A	
Jamestown Cladding & Profiling Ltd	00 353 45 434288	●									M	
John Parker & Sons Ltd	01227 783200								●	●	D/I	
Joseph Ash Galvanizing	01246 854650						●				N/A	
Jotun Paints (Europe) Ltd	01724 400000						●				N/A	
Kaltenbach Ltd	01234 213201					●					N/A	
Kingspan Structural Products	01944 712000	●									M	●
Lindapter International	01274 521444									●	M	
Longs Steel UK Ltd	01724 404040				●						M	
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	
PPG Performance Coatings UK Ltd	01773 814520						●				N/A	
Prodeck-Fixing Ltd	01278 780586	●									D/I	
Rainham Steel Co Ltd	01708 522311								●		D/I	
Sherwin-Williams Protective & Marine Coatings	01204 521771						●				M	○
Sika Ltd	01707 384444						●				M	
Simpson Strong-Tie	01827 255600									●	M	
Structural Metal Decks Ltd	01202 718898	●									M	●
Tata Steel Distribution UK & Ireland	01902 484000								●		D/I	
Tata Steel Ireland Service Centre	028 9266 0747								●		D/I	
Tata Steel Service Centre Dublin	00 353 1 405 0300								●		D/I	
Tata Steel Tubes	01536 402121				●						M	
Tata Steel UK Panels & Profiles	0845 3088330	●									M	
Tekla (UK) Ltd	0113 887 9790		●								N/A	
Tension Control Bolts Ltd	01948 667700						●			●	M	
voestalpine Metsec plc	0121 601 6000	●									M	●
Wedge Group Galvanizing Ltd	01909 486384						●				N/A	
Yamazaki Mazak UK Ltd	01905 755755					●					N/A	

Cellular Beams

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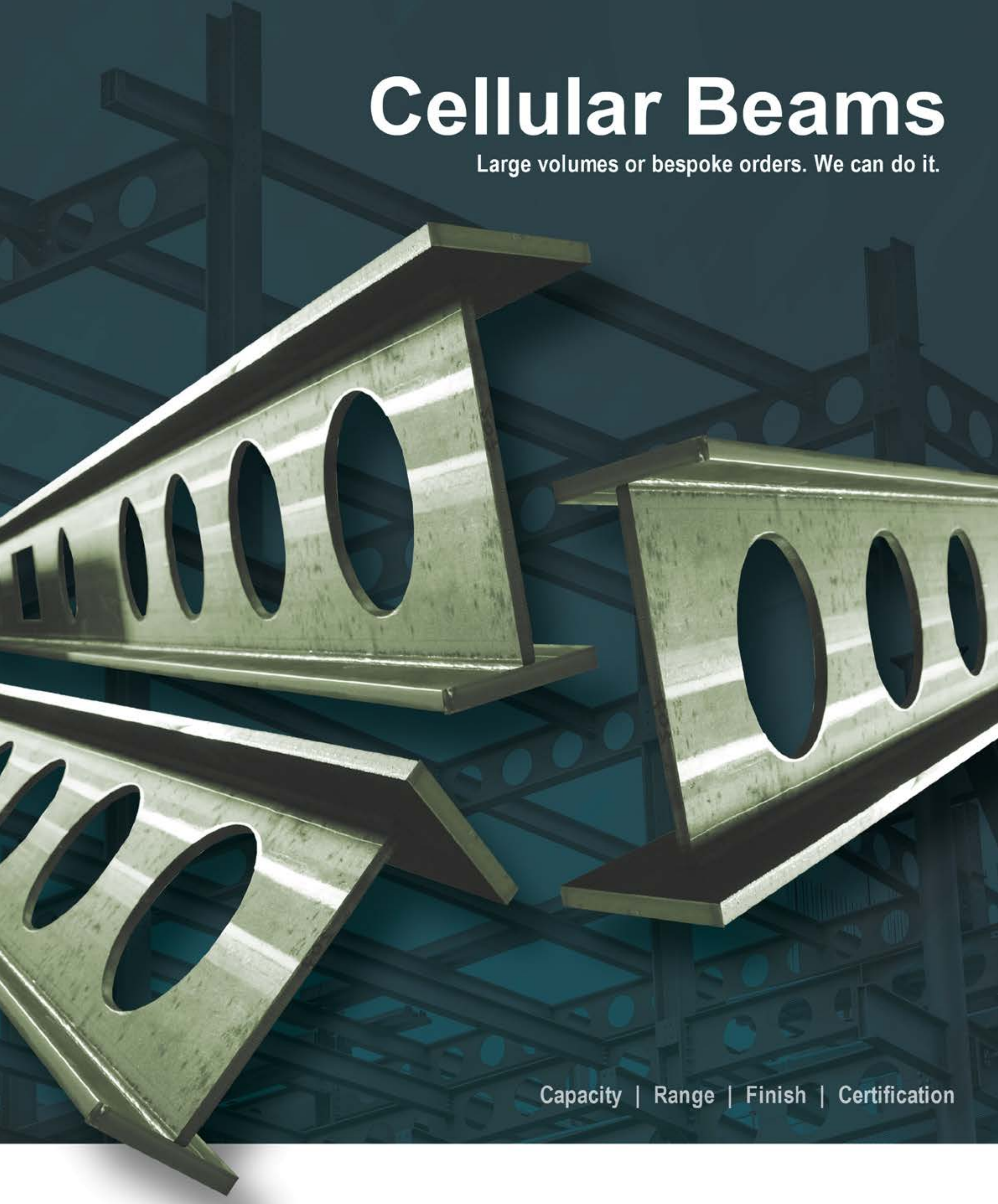

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