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NSC

Steel expands Reading tower

March 2016

Vol 24 No 3

In at the deep end

New schools for Home Counties

Steel transforms Bracknell

Blast resisting Grangemouth

Cover Image
Ashton [Old] Baths, Manchester
Main client: Tameside Council
Architect: PlaceFirst Architects
Main contractor: HH Smith & Sons
Structural engineer: Renaissance
Steelwork contractor: B D Structures
Steel tonnage: 65t

BCSA

TATA STEEL

SCI
Steel Knowledge

March 2016 Vol 24 No 3

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

Steel stays the competitive choice

Nick Barrett - Editor

Tender prices fell to unsustainable levels during the post credit crisis and recession years, placing the entire supply chain under pressure. Demand has recovered from those lows, though it hasn't reached the previous peak for structural steelwork, and there is still spare capacity in our sector.

There have recently been reports about some developers in London putting projects on the backburner because of rising tender prices and several are said to be revisiting their costings. This might easily backfire as the next move in tender prices could easily be upwards. Against a background of rising material costs, wage inflation and strong demand in other parts of the market, today's tender prices could look cheap in a year or so, especially if a rebound in oil prices forces the cost of materials up.

One thing the construction supply chain would agree on is that margins have been too tight in recent years so if developers are looking for price cuts the message is don't look for it in our margins.

For developers who decide to push on against whatever short-term headwinds there might be, there is at least some good news from the latest cost research by Gardiner & Theobald. The latest Steel Insight series article that appeared in Building magazine on 26 February shows that steel is maintaining the competitive edge that has brought it dominance in the key markets like multi-storey offices and single storey industrial buildings for so many years.

As can be seen from the project profiles in this – or any – month's issue of NSC, steel is consistently the cost-effective choice for the widest range of types of building, delivering benefits to sustainability, to construction programmes and to flexibility; sometimes it is steel that makes buildings possible at all.

Construction prices might have been on a rising trend recently, but steel retains its competitive cost edge and there is nothing on the horizon likely to change that.

NSC

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Plans submitted for City of London's tallest tower

The City of London's skyline could be radically altered yet again as plans for a 309.6m-tall tower have been submitted for planning approval.

The new tower will be the same height as The Shard – Europe's tallest building, which stands just across the river in Southwark.

Designs from Eric Parry architects plan the demolition of the headquarters of insurance giant Aviva to make way for a 73-storey steel-framed tower at 1 Undershaft.

The 90,000m² building would be able to accommodate 10,000 people and boast a viewing platform higher than that of The Shard, and London's highest public sky restaurant.

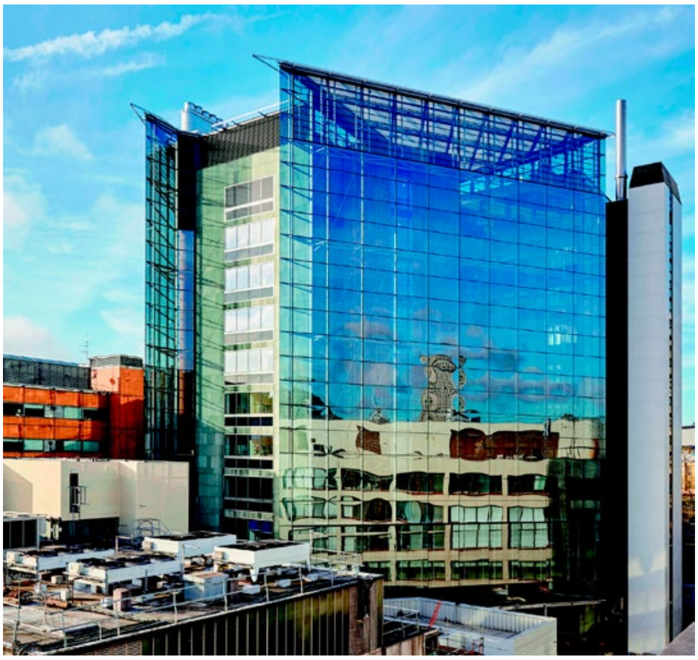
A conceptual design by Avery Associates for the previous owner of the 1 Undershaft site proposed an angular sloping sided glass tower peaking at 270m, a design that led to it being dubbed "The Fang".

The new design is for a more conventional office tower block with distinctive visible structural steel cross bracing.

It would stand 28m higher than the replacement steel-framed tower for the Pinnacle scheme at 22 Bishopsgate that could now only temporarily become the City's tallest building when it completes in 2019.

Both of these buildings will loom above a number of recent City skyscrapers, including the Leadenhall Building (Cheesegrater) and 20 Fenchurch Street (Walkie Talkie).

London currently has only 15 towers over 150m, lagging behind New York that has 188 and Hong Kong, the high-rise world champion with 302.



Recladding of St Thomas' Hospital East Wing completed

Contractor ISG has completed the £21M recladding of the 1966 built east wing at St Thomas' Hospital in central London.

The scheme involved the retention and refurbishment of the existing façade on the 13-storey tower, which stands across the Thames from the Houses of Parliament (see *NSC* May 2014).

This façade was made from slate, teak, stainless steel and ceramic tiles but had suffered from water ingress, excessive solar gain and inadequate lift capacity.

ISG added a new steel-framed glazed cladding system, creating a double-skinned façade along the building's western side and two new steel-framed atria along the east, housing new bed lifts and an art installation.

Project architect Hopkins said the project was completed without significant disruption to the hospital, which remained in use throughout the construction process.

Bourne Steel fabricated, supplied and erected much of the project's steelwork, including a prefabricated and modular lift shaft to accommodate two new patients lifts in the eastern atria.

Prior to installing the lift shaft, Bourne Steel erected the floor steelwork for the two atria. This was formed with a series of 600mm × 400mm jumbo box sections that were installed at second floor level above a triple-height basement.

Supporting the floors are CHS columns, and one feature Y-shaped column at the front that also supports the atria glazing.

Steel up for Met office supercomputer buildings

Steelwork erection has been completed on the £97M project to build accommodation for the Met Office's new weather forecasting supercomputer at Exeter Science Park.

Located a short distance from the Met Office's current headquarters, the computer will be housed in a purpose-built steel-framed structure [IT Hall] currently being built by a team led by main contractor Willmott Dixon.

A distinctive sloping two-storey steel-framed office structure, known as the Collaboration Space (pictured), is also under construction.

The IT Hall is a single storey portal-framed structure measuring approximately 90m long and 25m wide, but importantly offering a central 15m-wide column-free span for the computer hall.

The Collaboration Space is a far more complex steel structure leaning in two directions, which has required enhanced stability systems to resist the forces generated by the complex and eccentric geometry.

Using a single 50t-capacity mobile crane, William Haley Engineering erected the IT Hall first. The propped portal frame has sloping sides formed with raking columns, with two internal column lines providing the large open central space, while the two outer 5m wide spans accommodate ancillary spaces.

The hexagon-shaped Collaboration Space was the most challenging to design and erect. The structure's accommodation space is housed around a two-storey internal box based around a 7.2m × 4.8m grid pattern. The two main elevations, with the front sloping inwards and the back doing the reverse, are built from this steel box.

The Met Office supercomputer is due to be installed during August and it is scheduled to reach full capacity in 2017.

Building publishes latest Steel Insight

The latest in the Steel Insight series of supplements, sponsored by Steel for Life, has been published in *Building Magazine* and is also available for free at *www.steelconstruction.info*.

The six-page steel supplement features the latest construction cost comparison update from Gardiner & Theobald, an article on the Steel for Life initiative and two case studies of steel structures used in school campuses.

In the cost comparison, two building types are compared using various framing options. For building 1, a three-storey office, the framing options considered are: steel composite, steel and precast concrete slab, reinforced concrete flat slab and post-tensioned concrete flat slab.

Building 2 is an L-shaped eight-storey city centre office building and cost models were developed for a steel cellular composite frame and a post-tensioned concrete band beam and slab. For both buildings the steel composite option is the cheapest framing solution.

BCSA Director General Sarah McCann-Bartlett and BCSA President Wendy Coney explain Steel for Life, a new initiative aimed at promoting steel's benefits in construction.

Two school projects are highlighted, Holywell Learning Campus in North Wales and Wick Community Campus in Scotland.

Holywell is a complex steel-framed structure that resembles a figure-of-eight, when viewed from above. Using structural steelwork for this complex design was the only solution according to the project team.

Wick Community Campus is one of the UK's most remote construction sites and its location has played a significant role in the choice of suppliers and materials on the project, including the specification of a steel frame.

Aberdeen Union Square expansion announced

Developer Hammerson has announced that Union Square in Aberdeen has formally submitted an application for planning permission in principle (PPiP) to Aberdeen City Council for a multi-million pound expansion of one of Scotland's premier shopping destinations.

The proposed expansion includes new retail and leisure space, additional parking spaces, a 120-bedroom hotel, an expanded cinema, as well as reconfiguration of part of the centre's existing steel-framed shopping area.

As part of the proposals, options for improved vehicle access to Union Square will be brought forward to address comments received during the public consultation. The development would create around 2,000 new jobs.

Ryan Manson, General Manager, Union Square commented: '"The opportunity to extend Union Square will enable us to build upon our successful track record of providing the city with new and exciting retailers and restaurants by enhancing our existing retail and leisure offer, whilst delivering the right infrastructure to support it."

The existing Union Square retail development opened in 2009 and was one of the largest construction jobs to have been completed in Aberdeen. Severfield fabricated, supplied and erected 15,000t of steel for the project.

Steel construction sector remembers Victor Girardier

Leading engineer Victor Girardier, who is said to have presided over the revolution in structural engineering that occurred in the latter decades of the 20th Century, has died aged 80.

Initially as Chief Executive of one of Europe's largest steelwork companies in the 1980's, and then as Director of the Steel Construction Industry Federation (SCIF) in the 1990's, Mr Girardier played a significant role in introducing computer technology into the steel industry.

Born Edward Victor Girardier in Salford in 1935, he was educated at Manchester Grammar School and left at the age of sixteen when he joined a local steelwork manufacturing company, Edward Wood, based in Trafford Park Manchester.

He trained to be a structural engineer and subsequently joined Redpath Brown, also based in Trafford Park. After nationalisation of the British Steel industry in 1967, the company became part of Redpath Dorman Long (RDL), a division of British Steel Corporation.

In 1975 he became Commercial Manager of RDL's manufacturing division and then in 1978 Sales and Marketing Director of RDL International, targeting overseas contracts. In the early 1980s he was appointed Chief Executive of RDL.

British Steel Corporation sold RDL to the Trafalgar House Group in the late 80's and he became a director of the Trafalgar House Structural Division.

In response to a request from the steelwork industry, Trafalgar House agreed to a secondment, and he was appointed the Director of the Steel Construction Industry Federation.

The industry was aware of the need for its three main organisations, the BCSA,

British Steel and the SCI, to co-ordinate their market development activities.

Mr Girardier is credited with playing a leading role in this and his work was recognised with the award of a Fellowship of the BCSA.

After retirement he acted as a non-executive director for the Bone Group in the early 2000's, and for Caunton Engineering for more than 20 years.

Victor Girardier died on 3 February 2016, and his wife, Hilary, whom he first met at primary school in Didsbury, survives him, as well as his son Simon and daughter Helen.

NEWS IN BRIEF

This year's **MACH 2016**, the UK's premier manufacturing technologies event, to be held at Birmingham NEC April 11-15, will host the latest innovations in steel processing equipment. FICEP will be previewing its full range of steel plate, beam and angles processing machinery, Kaltenbach will be showing examples and technologies from its recently expanded product portfolio and Peddinghaus will also be showcasing equipment.

Severfield has seen its UK order book grow by a third to £246M in just three months signaling the structural steelwork sector is in good health. Chief Executive Officer Ian Lawson said the firm's operating margins were also on the rise in line with management expectations. In a trading statement, he said: "The market continues to present a good level of opportunities although as indicated in November's interim results, slippage in potential timescales still remains a risk as clients scrutinise forecast overall project costs with caution."

The 'Best Digital Campaign' category at the annual Construction Marketing Awards (CMA) was won by **voestalpine Metsec** for its video case study of the partially steel-framed 66 Queen Square, Bristol. The CMAs showcase the construction industry's creativity, innovation and effectiveness in marketing. There are a number of categories including best marketing campaign, best use of content, and best use of website as well as awards recognising the marketing agencies that support the industry.

The **University of Cambridge** has been granted planning permission for 'Project Capella' - a new £79M research facility being delivered by Kier and designed by architects from The Fairhursts Design Group. The six-storey steel-framed 18,000m^2 centre will be located adjacent to the Cancer Research UK Cambridge Institute within the Cambridge Biomedical Campus, and will provide state-of-the-art research laboratories.

Yorkshire County Cricket Club has unveiled plans for a £50M project to transform its Headingley Cricket Ground. The scheme includes the installation of floodlights and the rebuilding of the North/South Stand, which will become the centerpiece of the project. The capacity of the cricket ground will increase from 17,000 to 20,000.

AROUND THE PRESS

New Civil Engineer
March 2016
Expanded arteries
[Catthorpe Viaduct] – Finding room to build the six new bridge structures was the biggest challenge. Weathering steel was chosen for all exposed structural steelwork on the viaducts.

Building Magazine
26 February 2016
Strengthening steel
"The Steel for Life advisory board will be made up of representatives from across the constructional steelwork supply chain allowing a broader industry input than previous market development programmes," says BCSA's Sarah McCann-Bartlett.

Building Magazine
26 February 2016
Wick Community Campus
"Wick is also prone to high winds, which was factored into the construction programme, so it was important to pick a framing material that could be erected quickly, as is the case with steel. Both swimming pool and sports hall require long spans, another reason why steel was favoured," says project director Linda Shearer from Sweett Group.

Construction News
5 February 2016
Steel firms urge chancellor to back Swansea Bay lagoon
Steel businesses in both Wales and Yorkshire have told the chancellor the project would help replace jobs lost during the ongoing steel crisis, while also boosting the pipeline of work for surviving producers.

Construction News
29 January 2016
Hammerson's intricate watermark
[West Quay, Southampton] – The structure consists of long trusses that occupy the wall zones between the auditoria. We have used the height of the auditoria to maximise structural depth, which allows us to limit deflections and increase stiffness and vibration performance.

BBC Wales opts for a steel-framed HQ

More than 2,000t of structural steelwork will be fabricated, supplied and erected by Severfield for the new BBC Wales Broadcasting House in Cardiff.

The scheme for developer Rightacres will see ISG deliver the new steel-framed headquarters for BBC Cymru Wales with a signature structure designed by Foster + Partners.

Set to provide the BBC with a new home in a key location - opposite Cardiff Central Railway Station - the 14,000m² building is set over four floors and includes office, studio and production space, providing work space for over 1,200 staff.

Rightacres Project Director Jason Hyett said: "We have a great project team, led by Foster + Partners, supported by Arup and Gleeds and to ensure that we deliver the project to the level of quality expected by both the architect and our client, we needed a main contractor with the best credentials."

Alan Bainbridge, BBC Property, said: "Getting the BBC project from the design board to site has been a huge team effort and we are delighted that this project is now becoming a reality. We look forward to working with Rightacres and ISG and the respective design teams over the next few years to develop a facility which delivers real value for money".

Phil Brown, ISG's UK Construction Managing Director, commented: "Constructing the new headquarters for BBC Wales is a major win for the business and brings all of our office expertise to bear on one of the largest ever private developer-led projects to be built in Wales."

Galvanizing helps revitalize carbon plant

Manchester Galvanizing (part of the Wedge Group) has provided its hot-dip galvanizing treatment to a project which has seen the successful reactivation of a disused carbon plant in the West Midlands.

The company partnered the project's steelwork contractor to galvanize over 46t of structural steelwork at the Tipton site following a multi-million pound renovation of the facility.

The project saw the carbon plant's existing furnace extended with new steelwork columns installed to heighten the building's structure, as well as the production of internal steel platforms, access stairways, a replacement roof, and an external loading section.

The work will bring the plant back into operation with both the capacity and efficiency of the reactivation of the carbon increased – the process of which results in spent carbon returned to a high reusable quality.

A project spokesperson said: "Galvanizing of the internal steelworks was chosen for this specific project due to its inherent ability to provide long-term protection with no ongoing maintenance required.

"Due to the nature of the project there were occasions when we needed a very quick turnaround and the team at Manchester Galvanizing achieved this every time."

Steel proves a safe bet for Stoke headquarters

Steel erection for a new headquarters for online gambling giant bet365 has been completed.

Working on behalf of John Sisk & Son, James Killelea has fabricated, supplied and erected 850t of steel for the three-storey office building in Stoke-on-Trent.

The structure is located on a plot in Etruria formerly occupied by the offices of the local newspaper, The Sentinel.

Approximately 350t of Westok cellular beams have been used throughout the building to create the long spans that reach a maximum length of 15m.

James Killelea Contracts Director Bob Allan said: "Using three erection gangs and three cranes we completed the steel erection programme in 14 weeks, using 31,000 bolts in total."

Chelmsford's new John Lewis store tops out

The final block of the new 11,000m² steel-framed John Lewis store at Chelmsford's Bond Street development has been laid during a topping out ceremony.

John Lewis, the anchor store of the scheme, represents an £18M investment in the city, and is set to transform the city's retail offer.

The 27,800m² Bond Street shopping complex will provide Essex with its first ever John Lewis, alongside a new retail and leisure destination featuring open air shopping, a cinema complex as well as landscaped public spaces.

Working on behalf of main contractor Bowmer & Kirkland, Caunton Engineering is fabricating, supplying and erecting 1,800t of steel for the entire scheme.

The John Lewis store is the largest steel structure in the project and consists of four levels, including a basement. The topmost floor of the shop features a double row of 25m-long roof trusses, providing the level with a larger column-free retail trading area.

Tony Chambers, chairman of project developer Aquila, said: "We are delighted to have John Lewis at Chelmsford's Bond Street scheme, bringing its wide product offering to this thriving city and it's fantastic to see the store construction progressing.

"We are very proud that such an established brand is the anchor of the development. It's a very positive endorsement of the city and a clear testament to the strength and quality of the new destination we are creating."

The Bond Street development will open later this year.

Former BCSA President awarded OBE

Cairnhill Structures Director and former BCSA President Jack Sanderson has been awarded an OBE for his services to the steel industry and the local Lanarkshire Boys Brigade. Seventy-three year old Mr Sanderson received his medal from Prince Charles at a special reception at Buckingham Palace.

Scottish academy starts with steel

Forming part of the ongoing hub Scotland initiative, a new steel-framed secondary school is being delivered in the Fife town of Anstruther.

Working on behalf of main contractor BAM Construction, BHC has started erecting the project's main frame and it will ultimately install 520t of steel.

Replacing the existing school, the new steel-framed structure will also provide a home for the council's local office, a library, a base for police officers, and so the project is officially known as The Waid Community Campus incorporating Waid Academy.

Typically, the ground floor of the building houses the community facilities with the school occupying the first and second floors, with one of the exceptions being the dining area which is located within the centrally located atrium.

Steelwork contractor BHC's steel tonnage equates to approximately 1,400 individual pieces, requiring 2,850 connections and a grand total of 16,822 bolts.

During its15-week erection programme, BHC is using two 80t-capacity mobile cranes, in conjunction with various sized MEWPs, to erect the entire steel frame and install metal decking and precast planks.

The building is roughly square-shaped on plan with each elevation measuring approximately 65m-long. For the erection programme the building is divided into three zones, with each one completed to its full height before BHC moves onto the next zone.

Waid Academy is scheduled to be open in time for the 2017 autumn term.

Diary

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

Tuesday 8 & Wednesday 9 March 2016
Essential Steelwork Design - 2 days
This course introduces the concepts and principles of steel building design to EC3.
Birmingham.

Tuesday 22 March 2016
Steel Truss Design
1 hour lunchtime webinar Free to BCSA and SCI members, exploring steel truss design.

Thursday 14 April 2016
EC4 Composite Design
This course will cover the design of composite beams and slabs with reference to Eurocode 4 for composite construction (BS EN 1994-1-1).
Bristol

Tuesday 19 April 2016
Robustness Design for Steel Framing
1 hour lunchtime webinar Free to BCSA and SCI members, introducing design of steel framed buildings for robustness.

Thursday 28 April 2016
Steel Connection Design
This course is for designers and technicians wanting practical tuition in steel connection design.
London.

Tuesday 10 May 2016
Steel Building Design to EC3
This course will introduce experienced steel designers to the Eurocode provisions for steel design.
Reading.

Tuesday 24 May 2016
Steel Construction and the Circular Economy
1 hour lunchtime webinar free to BCSA and SCI members.

Wednesday 25 May 2016
Simple Beam & Column Design to EC3
NEW –Four hour course containing minimum theory and maximum hands-on member design – focussing on practical design using the Blue Book. The course is aimed at designers of orthodox structures where the resistance tables are the preferred way of selecting members.
Bristol.

Thursday 26 May 2016
Simple Beam & Column Design to EC3
NEW –Four hour course containing minimum theory and maximum hands-on member design – focussing on practical design using the Blue Book. The course is aimed at designers of orthodox structures where the resistance tables are the preferred way of selecting members.
Birmingham

New town makeover

Steel construction is playing a leading role in a £250M retail scheme that will transform a large swathe of Bracknell town centre.

Visualisation of a Lexicon mall

The Fenwick anchor store has three trading levels

The cinema block takes shape

One of the new towns built after the Second World War to ease inner city congestion and provide war weary families with modern housing, Bracknell is now getting a much-needed makeover.

Construction work is now under way on Phase 2 of a new retail quarter in the town centre designed by BDP and Chapman Taylor for Bracknell Regeneration Partnership, a joint venture between Legal & General and Schroders along with Bracknell Forest Council. Working on behalf of main contractor Mace, Severfield is undertaking all of the structural steelwork for phase two, as well as installing metal decking.

Known as The Lexicon, the scheme is a shopping and leisure destination, which promises a vibrant mix of brands and experiences and a high quality mix of shops and venues connected in a pedestrian-friendly environment.

Phase one of the scheme consisted of the construction of a steel-framed Waitrose supermarket that was completed in 2011. Acting as one of the anchors for the overall scheme, this structure was fabricated, supplied and erected by Billington Structures.

Phase two, which kicked off on site in 2015 covers an area of 60,000m^2 and comprises two department stores, retail units, restaurants and cafes, a 12-screen cinema, multi-storey car park and 92 apartments.

Prior to Mace starting on site, the demolition of the site's 1960s and 70s built shopping district had been completed. Early works included a huge earthmoving operation to level the sloping topography. Piling was then undertaken and this work has continued alongside the steel programme, although in areas where it had been completed, Severfield was able to begin erecting the new structures.

Mace Project Director Andrew James says six of the new structures within the scheme are steel-framed buildings and the material was chosen for its long-span qualities and speed of construction. Another important consideration is steel's flexibility and adaptability, which allows for different shop configurations to be installed if and when the client changes or retail requirements alter.

A further building within Phase two is also steel-framed and this is a nine-storey structure dating back to the 1980s (pictured above). Originally designed as an office block on top of a two-level retail podium, the structure is being renovated to accommodate residential units on the upper seven levels.

The original podium has been demolished and approximately 300t of new steelwork will be bolted to the existing tower to form a much larger two-level podium that will accommodate an H&M store as well as numerous food outlets.

The six new steel structures being erected by Severfield consist of two anchor department stores (Marks and Spencer, and Fenwick), and four other retail blocks, one of which incorporates the cinema complex.

The two 7,400m^2 department stores are situated either side of the concrete-framed mult-storey car park, and because they link directly into the facility their designs have dictated the latter's.

The M&S store is based around a 9.6m × 9.6m steel grid pattern that consists of a basement plant level and loading dock with two trading floors above. Each trading floor has a 6m floor-to-ceiling height that allows it to tie into alternate car park floors, as the latter structure is based around a 3m floor-

Bracknell's retail offering will be more than doubled

FACT FILE
The Lexicon, Bracknell, Berkshire
Main client: Legal & General/Schroders
Architect: BDP/ Chapman Taylor
Main contractor: Mace
Structural engineer: Arup
Steelwork contractor: Severfield
Steel tonnage: 4,200t

to-ceiling height.

M&S was the first building to be erected, as this part of the site's footprint was the first to have its groundworks completed.

"This area had a very steep slope that had to be infilled," says Mr James. "Plus getting the anchor stores erected first was important as they have the longest fit-out programmes."

Just before M&S was fully erected another Severfield erection gang had begun on the adjacent Fenwick store.

"Using a number of 80t-capacity mobile cranes and up to five gangs of erectors we have staggered the steel programme so at least two buildings are being progressed at any one time," explains Severfield Project Manager Robin Hamill.

The Fenwick store is based around a slightly larger 11.4m steel grid pattern incorporating three trading levels with an additional 1,400m^2 future expansion zone. With three trading floors to fit into a building with a similar height to the M&S store, and with the need to tie into the adjacent car park, the building has floor-to-ceiling heights of 5m.

To help reduce the floor depth the services are integrated within 750mm deep fabricated plate girders with 1,200mm wide × 450mm deep notches in the ends and 300mm diameter holes in the web.

The different floor-to-ceiling heights and number of floors within the anchor stores was client driven," explains Arup Project Engineer Ewan Smith. "It did mean some redesign work was necessary on the car park to align the floors.

"In order to keep the department stores' overall heights similar the Fenwick store has integrated services within cellular beams, while height wasn't an issue for the M&S structure so it has fewer floors and large services voids between floors."

The project's largest structure is known as building five, which measures 100m x 90m. It accommodates two levels of retail units, based on a typical 7.8m × 13.5m grid with the cinema located above on the third level. Some flexibility has been achieved within the retail floors as an extra mezzanine floor has been accommodated within the area to be taken by a Next store.

"The large retail grid works well with the cinema above," adds Mr Smith. "The auditoriums have to be column-free spaces and so their column locations have dictated the pattern below in the retail levels."

Completing the steel package are two more steel braced frame retail structures known as buildings four and eight. The former will accommodate double-height units with a mezzanine capability based around a 7.8m × 10.2m grid, while eight is similar in design except it has a larger 7.8m × 13.5m grid pattern.

The final steel-framed retail block [building eight] is situated on a plot separated from the main scheme by the existing pedestrianized High Street. This part of The Lexicon is known as Charles Square and it will also include an adjacent concrete structure.

"Logistics is a key issue as the site is very congested with numerous trades and surrounded by busy roads, the existing town centre retail area, a police station, council offices, a library and residential properties," says Mr James.

"When it comes to working at Charles Square, logistics will be even more challenging as one of the buildings is landlocked by the existing pedestrianized streets which remain open to the public throughout the development. This effectively cuts the project into three. There is no direct road access to one of the buildings and so deliveries of materials, such as steelwork, will have to be made through an existing structure that has been part-demolished and will form part of building eight in the completed scheme. We will use an online just-in-time delivery system to aid this work."

The project will utilise a variety of cladding materials including brick, timber, aluminium, coloured glazing, and gold/silver coloured copper cladding.

The Fenwick store in particular will standout as it will be clad in 5mm-thick perforated anodized aluminium rainscreen cladding, which will be backlit. This system is bespoke and has been developed specifically for this scheme.

The predestrianized streets within the scheme will be spanned by canopies formed with steel and glulam beams covered with ETFE.

Another key concept for the scheme is the public realm design, which forms part of the 'greening of Bracknell' to transform the character of the existing town. A large open space, which could be used as a outdoor auditorium, is being constructed between the M&S store and Waitrose.

The Lexicon is due to open in spring 2017.

Billington Structures erected the Phase one Waitrose store

Tower tops out with steel

How the completed Thames Tower will look

A 1970s concrete office block is being given a new lease of life with enlarged floorplates and four extra levels, all with the aid of steel construction. Martin Cooper reports from Reading.

FACT FILE
Thames Tower, Reading
Main client: Landid Property, Brockton Capital
Architect: dn-a architecture
Main contractor: Bowmer & Kirkland
Structural engineer: Peter Brett Associates
Steelwork contractor: Shipley Structures
Steel tonnage: 660t

What to do with 40 or 50-year old tower blocks when their usefulness is seemingly over is a problem many towns and cities throughout the UK are increasingly having to deal with.

Do you demolish the structure and start afresh by constructing a new building? Or do you refurbish the existing tower?

The latter has become the most popular choice, as it is the more cost-effective method. With reduced demolition to contend with, the overall refurbishment programme can begin immediately and consequently it will be completed far more quickly.

This was the challenge facing the clients of Thames Tower, a 12-storey concrete-framed 1970s office block that sits opposite Reading railway station and had been empty since 2010.

Because of its prominent city centre position, the unoccupied tower had become a local eyesore and the project team was anxious to conclude a speedy construction programme.

Initially there were plans to demolish the building and replace it with a new 25-storey tower including new foundations. However this grandiose design was shelved and a more economical solution was put forward whereby four new steel-framed office floors would be added to the top of the existing tower, with no foundation works.

dn-a Director, Stuart McLarty comments: “Thames Tower originally had stumpy proportions, which contradicted its name as a tower. Adding 4 additional floors, squaring the corners and removing the concrete spandrels to allow for towering windows will create a more elegant, proportionate building.

“Exposing the upper floors’ steel structure will highlight the contrast between the new steelwork and that of the old concrete Thames Tower, which is being reborn as a 21st Century workplace.”

Refurbishment work also includes stripping the building right back to its structural frame with the removal of its cladding, which will be replaced with a terracotta system to mirror redbrick buildings in the town.

“Steel is ideal for this kind of project as it is quick to erect and lightweight in comparison to other materials,” says Peter Brett Associates Director Fergal Kelly.

“By strengthening some of the concrete columns we have added new floors to the top of the building, and crucially we have been able to reduce costs by re-using all existing foundations.”

As well as the four additional steel-framed floors, steel construction has also played a role in maximising and extending the existing floors of the tower.

The structure’s original design had the perimeter columns protruding beyond the floorplates. For the new design, project steelwork contractor Shipley Structures has installed a series of new perimeter support beams that have been fitted and connected to the existing concrete columns.

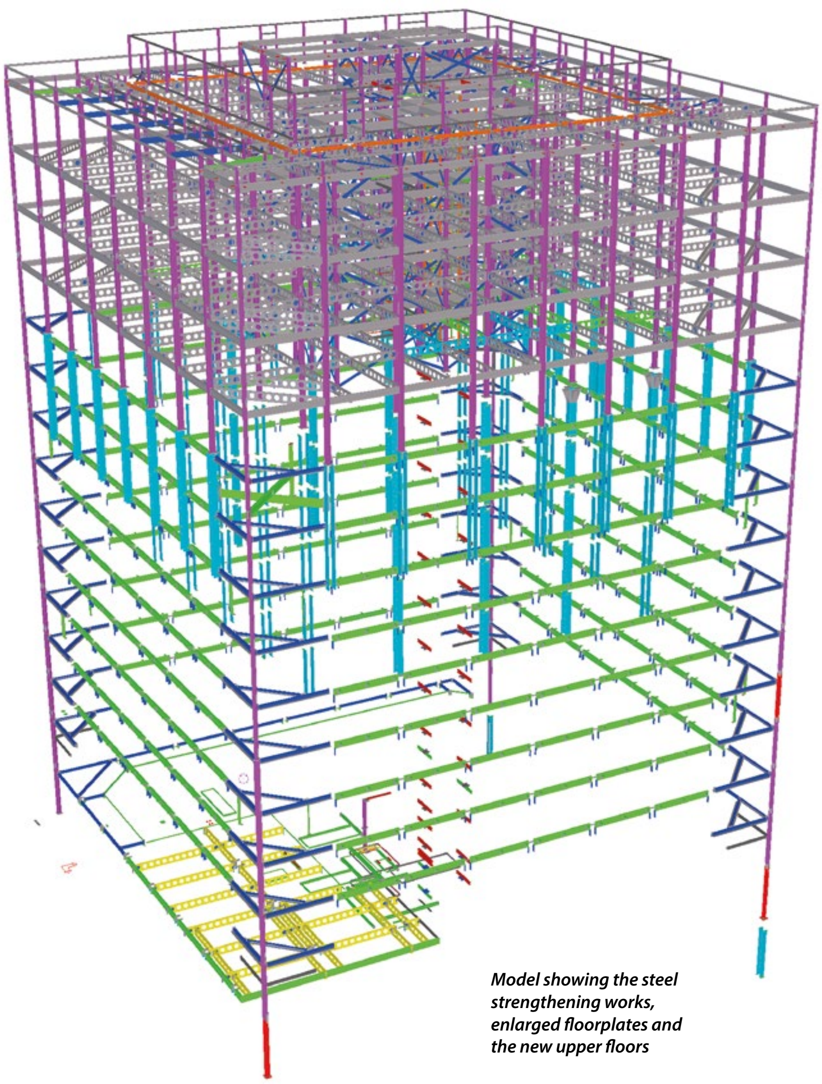
These beams support new metal decking and a concrete topping, which brings the floors flush to the exterior face of the columns.

“The beams have also provided the necessary support to allow the existing concrete perimeter upstands beams at level two up to 11 to be removed,” says Bowmer & Kirkland Senior Project Manager Bill Poole.

Altering the four corners of the building has further increased each of the tower’s existing commercial floorplates. Previously the corners featured a 45-degree chamfer, which has now been infilled to create a new perfectly square structure.

This was achieved by Shipley Structures installing a new steel column in each of the building’s four corners. Two new connecting floor beams were then added at each floor which, in turn, support metal decking that forms the new floor space.


Cellular beam construction for the new upper floors


Model showing the steel strengthening works, enlarged floorplates and the new upper floors

This work has increased the tower's floor space from 13,600m² to approximately 17,000m² of offices and 740m² of restaurant/café space.

"Before the new four-storeys of steelwork could be erected it was necessary for the existing concrete frame to be strengthened," explains Shipley Structures Director Chris Murphy. "And the concrete frame also needed to be strengthened in order to support the tower crane that was required for the erection programme."

A 500t-capacity mobile crane was required to install the site's tower crane. However, due to the poor ground conditions surrounding the site, the chosen spot for this large crane had to be piled and strengthened prior to its arrival.

"While these groundworks for the crane were being completed, we not only strengthened the concrete columns, but we also completed all of the perimeter steelwork for the existing tower," says Mr Murphy. "As there was no tower crane we had to use hoists and lift most of the steel up through the cores."

To strengthen the existing columns, flat 15mm-thick steel plates were attached to two faces of all internal columns from level six up to level ten. At levels nine and ten further strengthening plates were also fitted to the perimeter columns.

At level 10 additional plates and stiffener brackets were fitted to three internal concrete columns located below

▶14

"Exposing the upper floors' steel structure will highlight the contrast between the new steelwork and that of the old concrete Thames Tower, which is being reborn as a 21st Century workplace."

▶13 the tower crane location. After all of these strengthening plates had been anchored into place they were then sealed and resin bonded to the existing concrete columns.

Once the strengthening works had been completed and the tower crane installed, Shipley began the erection of the new steel floors atop the tower.

The new steelwork is bolted to the existing concrete columns, while in the corners the new frame connects to the steel columns previously erected by Shipley.

Predominantly based around a 6.3m × 5.8m internal grid to match the existing columns below, each new floor is formed with a series of Westok cellular beams that accommodate services and support metal decking. Westok's London Regional Engineer, James Way, outlined why the cellular beams were beneficial, "The use of composite cellular beams has kept the steel weight to an absolute minimum, while allowing M&E services to be distributed within the structural depth. The weight savings have been of particular benefit on this project by minimizing the strengthening required to the existing structure."

The structure has been built one floor at a time with the steel going up first and then the concrete being poured. Once this was completed and the concrete floor had cured, the works progressed to the next level with the team using the recently cast new floor as a surface for its mobile elevating work platforms.

This working method was chosen because of the lack of space to store any materials on the tower's roof or anywhere on the site.

"There are vehicular restrictions around the site which meant we could only accept small loads of steel which had to be erected the day they arrived on site," explains Mr Poole.

The steelwork for the new floors was completed in February and Thames Tower is due to be completed by early 2017.

Sheeting encloses the tower as the new floors are erected

Composite cellular beams

by SCI Associate Director David Brown

Long spans, light weight and services – combined with the demand for a low construction depth – leads to an integrated solution. Often, as at Thames Tower, the solution is a composite slab and a cellular beam. Composite cellular beams can be optimised to put steel where required – so the bottom half of the member is often a heavier section to accommodate the tension in what is effectively the bottom chord of a Vierendeel girder. The top half of the cellular beam may be smaller, since in composite construction the top half of the member is basically a separator between the tension in the bottom flange and the compression in the concrete slab.

Because the cellular beam acts like a Vierendeel girder, the web posts (the material remaining between the openings) and tee sections adjacent to openings can carry significant moments, especially towards the ends of the member. The structural checks are complex and best suited for software if an efficient solution is required. Where necessary, perhaps local to point loads or at the ends of members, cells can be filled in, or elongated openings may be strengthened with stiffeners. Good practice is to locate any necessary large openings away from the high shear zones.

In addition to extensive strength checks, the serviceability performance must be assessed, as this is obviously influenced by the openings in the beam. The additional deflection due to the openings in a cellular beam is typically 12 to 15% of that of an unperforated beam of the same depth. Fire protection is often provided

by intumescent coatings; the coating thickness depends on the specific coating product and the beam geometry and load.

Although the design of cellular beams may appear complex, comprehensive design guidance is available. P355 covers the design of composite beams with web openings in accordance with the Eurocodes and UK National Annexes. Looking to the future, a specific Eurocode part is planned, covering the design of cellular beams although this is unlikely to be published before 2020.

Successful integrated solutions demand a co-ordinated design between the structural designer and the services engineer – neither process should be carried out in isolation. A very helpful overview of integrated solutions, including examples of good (and not so good) practice is given in the Co-construct guide IEP2 referenced to the right.

Resources:

- IEP2 Service Co-ordination with Structural beams. Guidance for a Defect-free Interface, BSRIA, SCI
- P355 Design of composite beams with large web openings, SCI
- Fire protection for structural steel in buildings, ASFP

Links:

- http://www.steelconstruction.info/Fire_protecting_structural_steelwork#Protecting_cellular_beams
- http://www.steelconstruction.info/Long-span_beams#Composite_beams_with_web_openings
- http://www.steelconstruction.info/Service_integration#Composite_beams_with_web_openings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Ensuring a safe design

INEOS Olefins & Polymers UK, the country's largest privately-owned company and one of the world's largest chemical businesses, is building a new, state-of-the-art and blast resistant steel-framed headquarters.

Constructing a new office block within a large petrochemical works brings with it a host of unique challenges, the most important of which is to be blast resistant.

In the event of an accident involving combustive materials, the new building must be able to withstand any possible resultant blast, all of which requires a number of considerations to be implemented during the design stage.

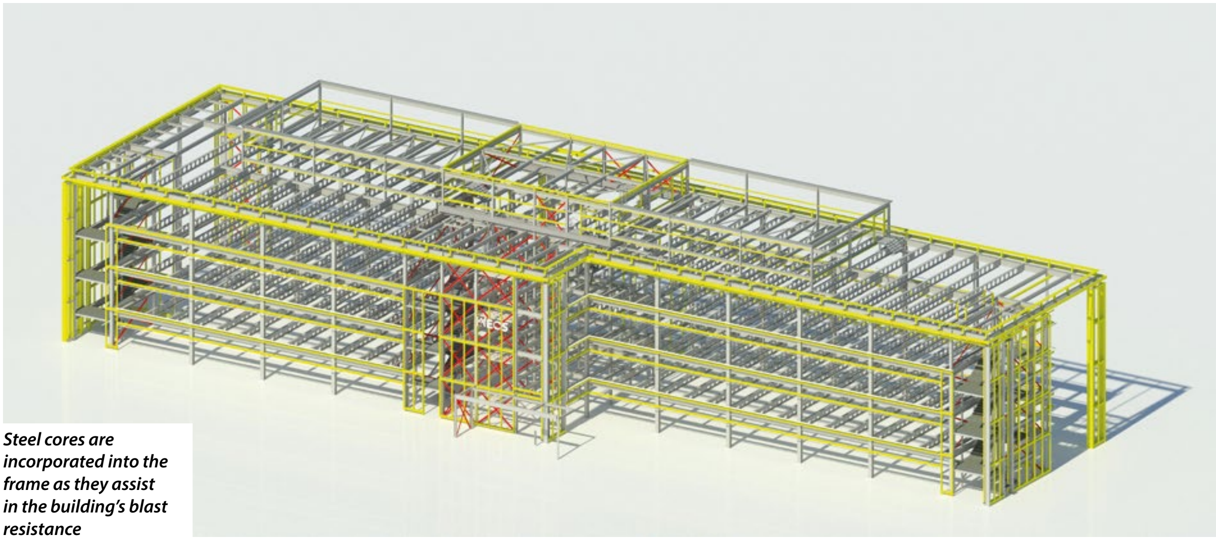
This is precisely the challenge set for the team currently constructing the £20M steel-framed headquarters building for INEOS at its Grangemouth facility in Stirlingshire.

"Because of the location, the design stage for this project was more onerous than would be expected for a job of this size," explains BAM Construction Project Manager Gary Brown. "Because the building is located within a major petrochemical complex the office HQ had to be designed to take this into account and so we employed a specialist blast engineer who had to review all of the initial designs, including the steel frame, secondary steel and cladding, to ensure everything was blast resistant."

Woolgar Hunter Senior Engineer Kenneth Irvine says: "We worked closely with Michael Laird Architects to develop a solution for the steel frame and cladding, which addresses the loading issue but still provides an elegant and economic building.

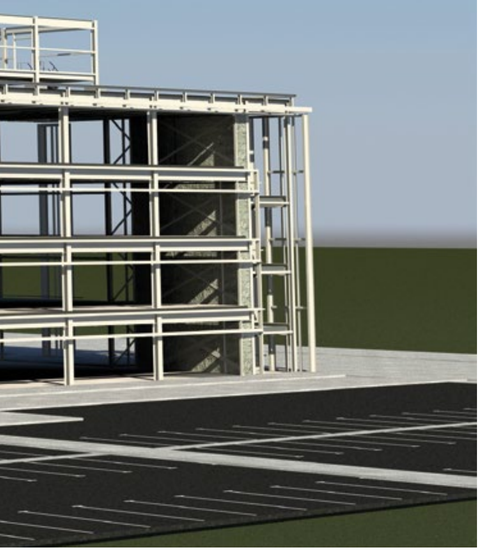
"The structural design had to take into account potential blast loadings and so the steel frame has to be flexible," explains Mr Irvine.

The requirement for the steel frame to be ductile in the event of a blast led the design team to choose steel-framed cores for the building, instead of the more rigid concrete versions.



Steel cores are incorporated into the frame as they assist in the building's blast resistance

FACT FILE
INEOS Headquarters, Grangemouth, Stirlingshire
Main client: INEOS UK
Architect: Michael Laird Architects
Main contractor: BAM Construction
Structural engineer: Woolgar Hunter
Steelwork contractor: BHC
Steel tonnage: 950t



Creating a manufacturing hub

INEOS operates 65 petrochemical plants worldwide and this is its largest facility. The new building forms part of INEOS' grand vision for the site as it plans to turn it into a manufacturing hub for the whole of the Central Belt of Scotland.

The company says the new building is just one part of the innovative redevelopment plans for Grangemouth. Old manufacturing plants and vacant buildings will make way for brownfield plots that will be made available to new businesses attracting investment into the area. These businesses will be able to benefit from the raw materials, existing power stream, logistics and other services provided by INEOS.

INEOS Olefins & Polymers CEO at Grangemouth John McNally says: "The site is undergoing a radical transformation with significant investment that will herald a new era in petrochemical manufacturing at Grangemouth."

"For the first time in many years, the business at Grangemouth will be able to bring its employees together in a way that suits the new business operation. It will improve productivity and collaboration with a single office building."

All of the cross bracing comprises 250mm × 12mm flat sections which were chosen as this steelwork offers more flexibility.

The only areas where flexibility is not required are the connections between the cross bracing and the main frame's columns. Here large stiffened connections have been designed to hold firm against blast loads. The 6,500m² steel-framed building will provide high-quality open-plan office space over four floors and will include meeting rooms, conference facilities and kitchens located on the ground floor.

Main contractor BAM Construction started work on the site in August 2015. The plot had already been cleared of its previous buildings, and so one of the initial tasks was to install a series of precast piles to a depth of between 35 and 40m.

The completion of the piling works then allowed steelwork contractor BHC to begin its steel erection programme.

The steelwork forms a braced frame that is based around a regular grid pattern of 7.5m × 18m. A series of 18m-long × 750mm-deep Westok cellular beams has been used throughout the structure, not only to create the desired open plan space but also to efficiently accommodate all of the services within the structural void.

"We've erected the entire steel frame using two 80t-capacity mobile cranes," says BHC Project Manager Bobby McCormick. "The 18m-long cellular beams, which each weigh 5.5t, were the heaviest and longest steel sections on the job."

BHC began by erecting the central area of the building, which contains the main core. Once this area was up and stable, the erection team was divided in two to work outwards in both directions simultaneously.

Although the structure is based around a large column-free design, there are a few internal columns and these are located around the centrally-positioned atrium and its adjacent core.

As well as the steelwork fabrication, supply and erection, BHC has also been responsible for the installation of metal decking and precast stairs.

As well in the central core, precast staircases are also positioned at either end of the building in secondary steel-framed cores.

All intumescent painting has been carried out by BHC offsite at its fabrication yard. Again for blast resistance, the paint specified for this building is of a higher specification than usually applied to commercial structures.

A steel frame was chosen as the best framing solution for this scheme as it helps achieve a faster construction programme. The scheme is currently on schedule to meet its August completion date.

The choice of steelwork has helped with a quick and cost effective construction programme

Seven up for schools

As part of the Government's Priority School Building Programme, Interserve and Kajima Partnerships JV has been awarded the design and build contract for seven steel-framed secondary schools north west of London. Martin Cooper reports from the Home Counties.

Spread across Hertfordshire, Luton and Reading, seven replacement secondary schools are currently under construction as one of the first batches of the Education Funding Agency's Priority School Building Programme, PF2 private finance model.

As well as the design and build contract, Interserve and Kajima JV will be responsible for all hard maintenance services over a 25 year period.

Kajima Partnerships Project Director, Craig Smailes, comments: "These much needed facilities will help address the needs of schools requiring urgent repair, while PF2 introduces some significant reforms to the traditional PFI model.

"What is now needed is a transparent pipeline of further projects to build on the experience and capability gained." Construction started on all schemes in March 2015 with the final school due to open in November 2016.

To create a cost-effective and efficient construction programme, the team has developed a solution that standardises the classroom design and allows for similar corridor layouts.

Predominately three storeys high, each school benefits from a large centrally-positioned atrium, which acts as a conduit between separate teaching blocks.

Interserve's Associate Director Andy Pearson says: "All of the schools have similar design principles, although their layouts have been adapted to fit into their respective footprints, some of which are on very tight sites."

A steel-frame supporting precast planks has been chosen as the most cost-effective design for all of the main school buildings. Long-span areas such as sports halls and assembly halls are formed with cellular steel beams, with the exception of the sports hall at Reading Girls' School.

Due to the lack of space on site, this sports hall is spanned by a series of 18m-long transfer beams that supports construction of classrooms above.

Approximately 50 per cent of all classrooms are formed around a 7.2m by 7.8m grid pattern. Where a larger room is required, the standard structural grid is maintained and additional beams are provided where necessary, to avoid locating columns within rooms.

The chosen structural solution, which uses a steel frame to support precast concrete plank soffits, has also helped the school buildings benefit from heating and cooling gains.

These are achieved through taking advantage of the high thermal mass qualities of the composite design, which is able to absorb and store heat. This in turn reduces the requirements for mechanical ventilation and cooling, which contributes to an overall saving in running costs of each school.

Senior Engineer at Arup Mike Wood says: "To mobilise the thermal mass effectively, the precast plank soffits are left exposed in all of the classrooms."

All of the schools are being built adjacent to the existing premises, while maintaining sports pitches and other sports facilities. Once the new buildings are occupied, Interserve will demolish the old schools and create new car parks and improved sports pitches.

The only exceptions to this were at Goffs School near Cheshunt, and Stopsley High School in Luton. Here the sites are particularly tight, therefore demolition of some existing buildings had to be completed before the construction programme got under way.

At both of these schools, temporary classrooms have been provided for the duration of the project.

Interserve is also taking the opportunity to aid the local communities while constructing the school.

Mr Pearson, continues: "As well as building the schools, providing some 900 new schools places, Interserve has already created over 40 new jobs, employed 13 graduates, supported almost 30 individual work placements and provided guidance at over 46 individual curriculum support sessions within the schools, covering career advice, practical sessions and employability support."

FACT FILE
Bishop's Hatfield Girls' School, Hatfield

Main client: Education Funding Agency
Contractor: Interserve Kajima JV
Architect: Rock Townsend
Structural Engineer: Arup
Steelwork contractor: Leach Structural Steelwork
Steel tonnage: 475t

FACT FILE
Goffs School, near Cheshunt

Main client: Education Funding Agency
Contractor: Interserve Kajima JV
Architect: Rock Townsend
Structural Engineer: Arup
Steelwork contractor: Leach Structural Steelwork
Steel tonnage: 650t

Steelwork goes up in front of Longdean's retained sports hall

The braced frames are erected around a regular grid pattern

Top of the class design

Longdean School in Hemel Hempstead is fairly typical of the entire programme, as the new buildings will replace an existing school comprising 1950s and 1970s structures.

The Longdean site is also the only one within the seven-school programme not subject to a confined and tight working footprint.

Construction work is taking place adjacent to the old school. Once the new build is open to students in November 2016, work will commence on demolishing the old structures with the entire job completed in June 2017.

Longdean is one of only two jobs in the programme where a retained sports hall is being incorporated into the scheme. This stand-alone structure was only built in the 1990s and is still suitable for the needs of a modern school.

This site is blessed with space and, due to Longdean's central position to all of the other school projects, Interserve has set up its main office compound here.

The new build consists of two structurally independent steel-framed teaching wings positioned end-to-end and separated by a movement joint. The meeting point of the two blocks accommodates the school entrance and a full height atrium.

Although the atriums at the schools all differ in size and shape, depending on the individual school design, each one is a full height open void, spanned by link bridges and topped with a glazed roof light.

These large open voids also play an integral role in the structure's ventilation system by keeping the surrounding classrooms cool.

Interserve's project manager for Longdean Lee Williams, says: "The rectangular teaching wings are both three-storeys high, although one of the structures incorporates a lower ground floor covering about 20 per cent of the project's footprint. The design incorporates the site's slope, so one block has some additional teaching space."

Erecting the steel frame immediately followed the groundworks programme. Steelwork contractor Hambleton Steel erected the steel package using its own mobile cranes and two gangs of erectors. The package, like all of the programme's steel packages, also included installing precast planks, stairs and lift shafts.

Hambleton Steel Contracts Manager Doug Willis, said: "It made sense that the steelwork contractor installed the precast elements in and around the steel frame, not just to make sequencing between trades easier, but also because we had the craneage already on site."

FACT FILE
Longdean School, Hemel Hempstead
Main client: Education Funding Agency
Contractor: Interserve Kajima JV
Architect: Maber
Structural Engineer: Arup
Steelwork contractor: Hambleton Steel
Steel tonnage: 509t

FACT FILE
Reading Girls' School, Reading
Main client: Education Funding Agency
Contractor: Interserve Kajima JV
Architect: Maber
Structural Engineer: Arup
Steelwork contractor: Leach Structural Steelwork
Steel tonnage: 479t

FACT FILE
Stopsley High School, Luton
Main client: Education Funding Agency
Contractor: Interserve Kajima JV
Architect: Rock Townsend
Structural Engineer: Arup
Steelwork contractor: Hambleton Steel
Steel tonnage: 522t

FACT FILE
Kings Langley School, Kings Langley
Main client: Education Funding Agency
Contractor: Interserve Kajima JV
Architect: Rock Townsend
Structural Engineer: Arup
Steelwork contractor: Leach Structural Steelwork
Steel tonnage: 555t

Concept school design

The redevelopment of Kings Langley School represents the original concept design for the entire programme. It was the first to be designed and it is the blueprint for all of the six schools that have followed.

Plans for the school to undergo a major development were initially submitted to the local council back in November 2013. The rebuild will replace the existing secondary school and help increase its student capacity from 1,085 to 1,180, while also improving the quality of facilities at the school. It is expected to be finished in July 2016.

Interserve's Project Manager for Kings Langley School John Harvey, says: "It's a very tight site, which of course presents a number of challenges we've had to overcome; such as having to bring in materials on a just-in-time basis as there's little room for storage."

Kings Langley's atrium and sports hall

"We also have to share an entrance with the school so all deliveries have to be timed so as not to coincide with its opening and closing times."

The new school is a three-storey structure containing a large central atrium and an attached sports hall.

Based around the standardised grid pattern, the school contains all of the programme's principal elements such as bracing secreted in partition walls and many offsite-manufactured components.

One of the main standardised steel components is the steel-framed roof lights that adorn all of the school's uppermost corridors. These are fabricated by the steelwork contractor and brought to site as completed units, measuring 2m × 1m, and then installed along with the roof steelwork.

Steelwork contractor Leach Structural Steelwork completed the steel programme at Kings Langley in December, utilising one 60t-capacity mobile crane and two erection gangs.

The overall programme also includes the construction of a multi-use games area (MUGA), with two full-size football pitches, three tennis and netball courts, an under-14s football pitch and five cricket strips.

The school will also be getting a new drop-off zone to ease congestion on surrounding roads, with a new turning circle which has enough space for eight coaches, and a covered outdoor amphitheatre.

FACT FILE
Westfield Academy, Watford
Main client: Education Funding Agency
Contractor: Interserve Kajima JV
Architect: Maber
Structural Engineer: Arup
Steelwork contractor: Hambleton Steel
Steel tonnage: 544t

Extra storey for biggest academy

Visualisation of Westfield's footbridge entrance

The new Westfield Academy in Watford is the only four-storey school in the programme. It is formed from two rectangular teaching wings that splay outwards in a V-shape from a central circulation area that accommodates a large entrance hall and atrium.

Westfield has the most pupils and consequently the design needed to accommodate sufficient classroom space while also blending the structure into its surroundings.

As none of the nearby buildings exceed three-storeys, a four-storey structure would have ordinarily stood out. However, taking advantage of the site's sloping topography, a four-level structure has been erected, which from a distance looks like it only has three levels.

Project Leader at Maber Jonathan Coleflax says: "Due to site constraints we were unable to increase the school's footprint, so a further storey has been introduced to achieve the requirements of the school. By utilising the existing topography of the site, the lowest floor appears below ground level, giving the appearance of three storeys when viewed from the main road."

Access to the new school from the existing school's site, which also includes a retained sports hall, is via a footbridge. This pedestrian link enters the structure's entrance hall/atrium at first floor level, which again accentuates the building's three-level appearance.

Also within the atrium is a movement joint that structurally separates the two steel-framed school teaching wings.

In keeping with the programme's standardised design, bracing that is predominantly located in corridors provides the structural stability.

The only exception to the standard design is the steel frame supporting precast planks in the school's second floor assembly hall, which is a double height space spanned by 18m-long cellular beams.

Hambleton Steel erected the steel and installed the precast units using one mobile crane and two erection gangs each working on one of the school wings.

The steelwork programme was completed in January and the new Westfield Academy is due to be open in time for this year's autumn term.

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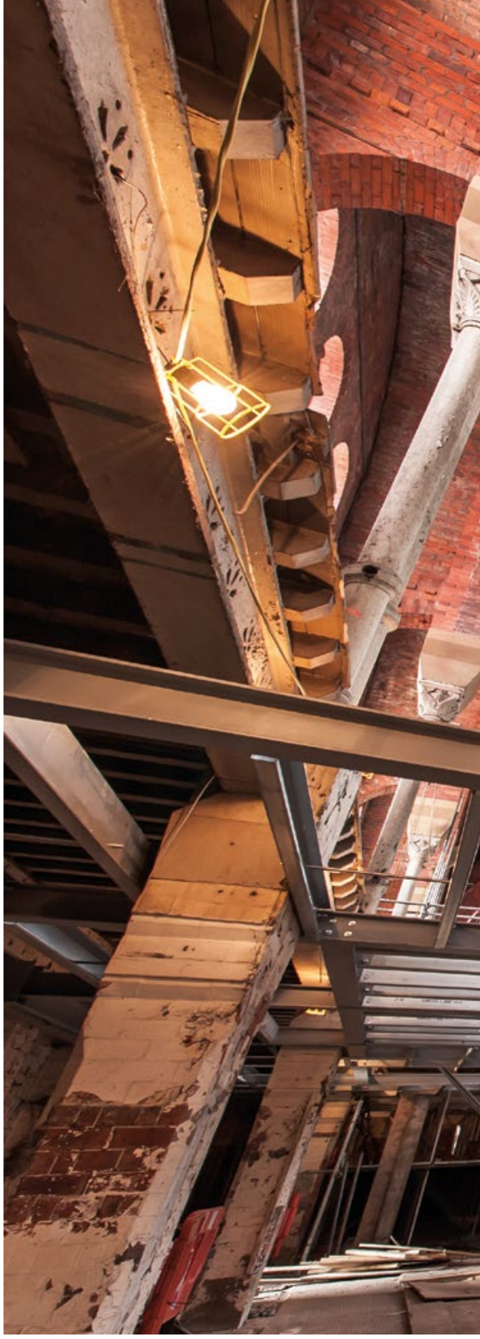
Steel dives in for pool restoration

Akin to inserting a ship into a bottle, a steel-frame has been delivered through a narrow doorway piece-small and erected inside a renovated former Victorian swimming baths in Manchester.

The clad pod nears completion



FACT FILE
Ashton [Old] Baths, Manchester
Main Client: Tameside Council
Architect: PlaceFirst Architects
Main contractor: HH Smith & Sons
Structural engineer: Renaissance
Steelwork contractor: B D Structures
Steel tonnage: 65t

Opened in 1870 at a cost of £16,000 Ashton Old Baths was one of the first and largest municipal swimming baths in the country.

Built of brick, with a wrought iron upper frame supporting a large vaulted timber roof, the building was a local landmark as its 36.5m-high tower, which housed the flues from the steam boilers and heaters, made it visible for miles around.

Unfortunately, for the last four decades the building has been empty, closing to the pubic in 1975 when a newer baths was opened nearby.

Allowed to deteriorate and plagued by vandalism, the building was sadly transformed from landmark to local eyesore until the Grade II listed building was bought by specialist developer PlaceFirst two years ago.

The company has recently completed a project that has brought new life back into the old building by creating a unique business space for local companies within the restored structure.

Restoration work on the building included extensive repairs and renovation to the exterior elevations as well as the timber roof. However, the most interesting aspect of the multi-million pound project was inside the structure where an office pod providing three levels of accommodation has been built.

Constructing office space inside the Old Baths has been likened to inserting a ship into a bottle, as the listed building had to remain intact during the work, which meant all materials and machinery had to be delivered through a narrow doorway.

"Steel was chosen for this job primarily for cost, but also because it could be brought to site in small loads which would facilitate delivery through the narrow door, while lightweight slender members allowed the frame to be easily erected and not overload the foundations" says Renaissance Director Kevin Gilsenan.

The swimming pool had previously been concreted over and the free-standing steel-framed structure is founded on piled foundations, which had been installed through the infill to depth of 15m. A mini-piling rig had to be used for this work, as the machine also had to be fed through the narrow entrance.

"The steelwork was delivered to the main building on articulated lorries. It was offloaded with a tele-handler and then manoeuvred into the building to laydown areas," explains B D Structures Managing Director Chris Heys. "The steelwork was then erected with a mini crane, with connection access mainly via electric scissor lifts."

Because space was at a premium inside the building, the three-level high steel frame was erected from the furthest point away from the entrance first, so the erectors could work their way towards the entrance. The entire steel frame, including its lightweight plywood flooring, was completed in six weeks.

In order to aid the erection process and make the frame stable once the initial bay was erected it has been designed as a sway

All materials and equipment had to enter the building via a narrow door

frame with moment connections.

The steel-framed pod measures approximately 30m long × 12m wide and sits centrally within the main pool old hall.

"The position and shape of the pod will allow users to view the restored interior as the free-standing steel structure maintains the integrity of the old building as it does not connect or interfere with existing facades," says PlaceFirst Architects Director Neil Brown.

The steel frame is built around a regular grid pattern of 3.2m × 6m, creating 600m² of office accommodation. There are two rows of internal columns, as long clear column-free spans would have meant heavier beams and the team needed to keep the frame as light as possible.

"We had to weigh up our options, clear spans or a light frame, and a light frame was more important," says Mr Gilsenan. "We managed to use 152UCs throughout."

However, flexibility has been built into the pod so that partitions can be added or taken out depending on the size of office each client requires.

Above ground floor, the two upper office floors are contained within a barrel-shaped structure formed by cantilevering facetted columns.

Some of the connections were quite a challenge to detail, particularly where the slim cranked columns and floor beams (152UC) intersected at floor levels.

"These were all moment connections and had very little space and depth to develop their forces. Added to this there were cladding rail connections, which were bracketed off the frame at varying angles," adds Mr Heys.

Topping the three levels of office accommodation, the pod has an open terrace to be used for seminars or conferences, and offering the best views of the restored timber roof.

Access to all the levels within the pod is via a centrally positioned steel staircase, which when fully erected consisted of 5t of steelwork.

The project has achieved a BREEAM "Very Good' rating and is due to open later this year.

The restored building will be a local landmark once again

The upper level of the pod is an open terrace

LTB in the Eurocodes – Back to the Future

In Part 1, David Brown of the SCI looked at comparisons between lateral torsional buckling in BS 449 and BS 5950. In Part 2, the comparison is extended to the current Eurocode – and what might happen as the Eurocode is revised.

There have been several articles on BS EN 1993-1-1 and lateral torsional buckling, covering numerical examples and the calculation of the C_1 factor to deal with non-uniform bending moment diagrams. The emphasis has always been that the physics has not changed, a truth which should have been reinforced when the background to BS 449 and BS 5950 was reviewed in Part 1.

The Eurocode is perhaps clearer than previous steel design codes. LTB is always based on the elastic critical moment – it was in BS 449 and BS 5590; this is now explicit in EC3. The criticism of the European Standard is that expressions for M_{cr} are not given in the Standard – according to other Europeans, this is expected to be known by designers, or extracted from other resources – something that the Standard does not need to provide. The closed formula is complicated, just like the expression for the elastic critical stress in BS 449, but at least there are software tools and freely available software to calculate this moment.

The physics of a non-uniform moment is dealt with by the C_1 factor, with a second adjustment via the f factor (but only if using the special case for rolled sections in 6.3.2.3). Perhaps as expected, with more test data available and many more numerical simulations possible, the Eurocode allows more finesse within the buckling curves. Instead of the one single curve in BS 449 and BS 5950, four curves are available, depending on the cross-section. The Eurocode is further complicated with two families of buckling curves; the "general case" in clause 6.3.2.2 and a set of expressions for rolled sections (called "special" in this article). If verifying a rolled section, the "special" set of expressions in clause 6.3.2.3 are highly recommended, especially with a non-uniform bending moment, as the calculated resistance is significantly higher than that calculated using the "general case".

A comparison between the LTB curves from BS 5950, the "general case" and the "special case" is shown in Figure 5. For the particular beam examined, the "general case" and "special case" use curves c and d respectively.

The EC3 "special case" curve has a similar plateau length to BS 5950, but then provides a larger resistance at all slenderness. The increase in resistance in the Eurocode may appear small in Figure 5, but may be as much as 25% and more for some beam profiles. The increase in resistance is more significant as slenderness increases. The conservatism of the "general case" can also be seen in Figure 5; the plateau is short (limited to a slenderness of 0.2) and then a reduced resistance compared to the "special case".

The difference between the "general case" and the "special case" for rolled sections becomes more significant for non-uniform bending moments, since the beneficial effect of f from clause 6.3.2.3(2) can only be applied to the "special case". Figure 6 shows the comparison with a triangular bending moment diagram ($C_1 = 1.77$, $m_{LT} = 0.6$). In BS 5950, the influence of m_{LT} is outside the calculation of the bending resistance M_b; the curve shows the effective reduction factor after allowing for m_{LT}. The increase in resistance calculated using the "special case" is up to 50% higher than that determined using the "general case".

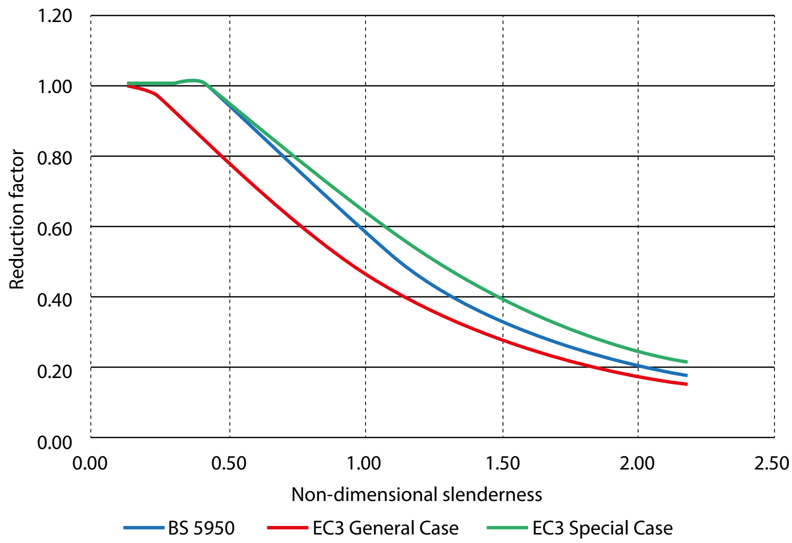


Figure 5: Comparison between BS 5950 and EC3; uniform bending moment diagram

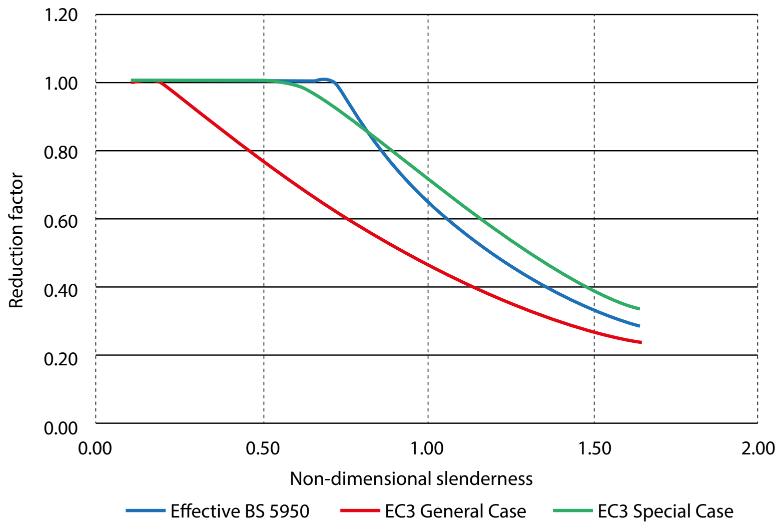


Figure 6: Comparison between BS 5950 and EC3; Triangular bending moment diagram

Where to next?

The Eurocodes are currently being revised, with a target date around 2020 for an amendment. It is likely that the LTB curves will be amended, though this is by no means certain. There is much discussion to be undertaken before the amendment is released. Accompanying the amended Standard will be a revised

Variable	Current ("Special Case")	Proposed
α_{LT}	0.34	$0.16\sqrt{\frac{W_{el,y}}{W_{el,z}}} \le 0.49$
ϕ_{LT}	$0.5\left[1+\alpha_{LT}(\bar{\lambda}_{LT}-\beta\bar{\lambda}_{LT,0})+\beta\bar{\lambda}_{LT}^2\right]$	$0.5\left[1+\varphi\left(\frac{\bar{\lambda}_{LT}^2}{\bar{\lambda}_z^2}\alpha_{LT}(\bar{\lambda}_z-0.2)\right)+\bar{\lambda}_{LT}^2\right]$
χ_{LT}	$\frac{1}{\phi_{LT}+\sqrt{\phi_{LT}^2-\beta\bar{\lambda}_{LT}^2}}$	$\frac{\varphi}{\phi_{LT}+\sqrt{\phi_{LT}^2-\varphi\bar{\lambda}_{LT}^2}}$
f	$1-0.5(1-k_c)\left[1-2(\bar{\lambda}_{LT}-0.8)^2\right]$	

UK National Annex, which will mean the UK (where allowed) can influence the final outcome within our shores. The proposed buckling curves may have more theoretical justification than the current set of expressions. As with most work associated with the development of design Standards, the majority of the enthusiasm tends to come from those with an academic background. Perhaps academic colleagues have the time and opportunity to make a contribution, but it certainly influences the final output.

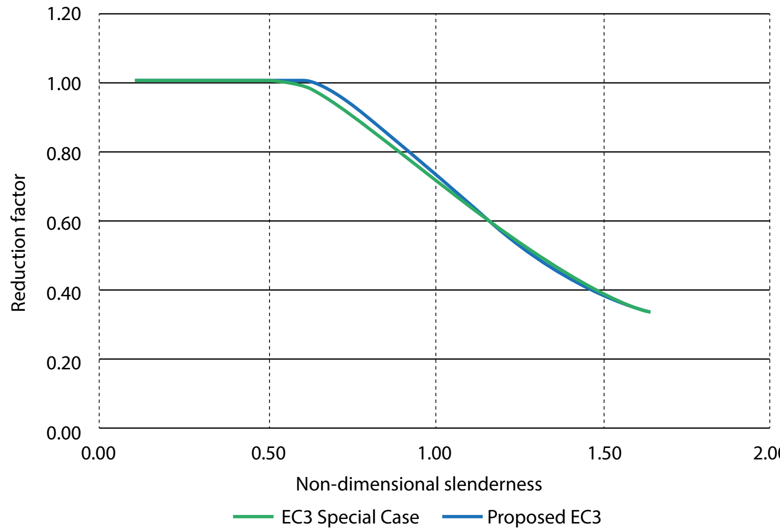


Figure 7: Comparison between existing and proposed EC3 rules; 457 × 191 × 98; triangular bending moment diagram

At present, it is far too early to be confident any detail in the amendment, so the discussion from now on becomes rather less reliable. The proposed amendment dispenses with the "general case" and the "special case" in favour of a single set of curves. A comparison between the two formulations is shown above, for beams where $h/b < 2$ (i.e. curve b in the current Standard).

In the proposed equations, φ depends on the shape of the bending moment diagram, rather like k_c in the current formulation. The value of the imperfection factor, α_{LT} becomes a variable which depends on the ratio between the major and minor axis elastic moduli rather than a constant, and approaches the value currently given for minor axis flexural buckling. In addition to the slenderness for lateral torsional buckling, the minor axis slenderness for flexural buckling, $\bar{\lambda}_z$, becomes an important part of the proposed process. A further notable change is that the plateau only extends to a slenderness of 0.2 (which is the same as the flexural buckling curve). The proposed LTB curves deliver higher resistances than the "general case", but are less attractive than the "special case".

A general comparison between the current rules and the proposed amendments is not possible, as the effect varies with the beam profile and the shape of the bending moment diagram. Figure 7 shows the comparison for a 457 × 191 × 98 UB with a triangular bending moment diagram; the difference between the "special case" and the proposed rules is marginal – what's not to like?

Figure 8 shows the comparison for the same beam with a uniform bending moment diagram. In this comparison the different plateau lengths are clearly seen; the proposed rules deliver a reduced resistance across the full range of slenderness, compared to the "special case".

Figure 9 also shows a rather less attractive comparison, for a 305 × 165 × 40 UB with a bending moment diagram due to a UDL. The proposed rules deliver less resistance than the "special case" across the whole range of slenderness. For this beam and loading, at high slenderness the proposed rules deliver only 84% of the current "special case" resistance, which is a significant reduction.

A perfect storm approaching?

At the same time as amendments to the resistance functions are being discussed, research is also underway considering the γ_{M1} value, which is used when calculating buckling resistance. The current recommended value in the Eurocode (which is adopted in the UK National Annex) is 1.0. It seems likely that some increase in reliability will be proposed – which may be to increase the γ_{M1} value directly, or the same effect may be achieved by further adjustments to the resistance functions. There remains much debate before agreement is reached, but there is a strong possibility that LTB resistances will be reduced in 2020 – a combination of the revised formulae and the effect of an increase in γ_{M1}.

The practical effect of changes to the resistance functions will mean that existing Eurocode design software and design aids, such as the Blue Book, will need to be updated, even if (in some circumstances) the change is small. As was demonstrated in Figure 9, the potential change in resistance could be significant – it would be inappropriate to continue to use out-of-date resources. LTB checks appear in very many SCI publications as part of worked examples, so the task of revision is certainly not trivial.

Perhaps the more significant concern is change to the Eurocodes when many designers are still not using them, or are in the early stages of transition. Although the Eurocodes have been available since 2005 (and so changes in 2020 after 15 years in use are perhaps not unreasonable), for many 'late adopters' the 2020 revisions may seem rather early.

A concluding reminder – the proposals are not yet agreed, so may well change before the amendment. The effect of the UK National Annex may also change the comparisons made in this article. No doubt nearer the time there will be plenty of articles looking at the impact of whatever is finally agreed.

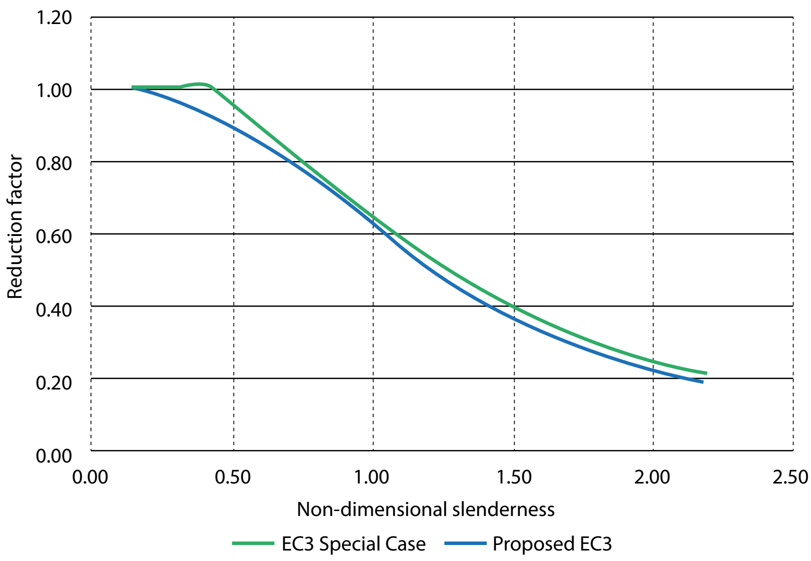


Figure 8: Comparison between existing and proposed EC3 rules; 457 × 191 × 98; uniform bending moment diagram

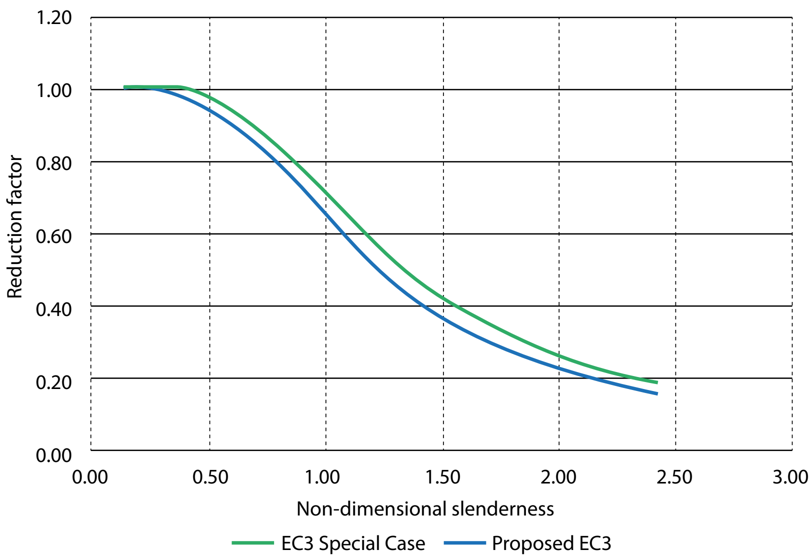


Figure 9: Comparison between existing and proposed EC3 rules; 305 × 165 × 40; bending moment diagram from a UDL

New and revised codes & standards

From BSI Updates February 2016

BS EN PUBLICATIONS

BS EN ISO 636:2015
Welding consumables. Rods, wires and deposits for tungsten inert gas welding of non-alloy and fine-grain steels. Classification
Supersedes BS EN ISO 636:2008

BS EN ISO 1071:2015
Welding consumables. Covered electrodes, wires, rods and tubular cored electrodes for fusion welding of cast iron. Classification
Supersedes BS EN ISO 1071:2003

BS EN ISO 17632:2015
Welding consumables. Tubular cored electrodes for gas shielded and non-gas shielded metal arc welding of non-alloy and fine grain steels. Classification
Supersedes BS EN ISO 17632:2008

BS IMPLEMENTATIONS

BS ISO 26843:2015
Metallic materials. Measurement of fracture toughness at impact loading rates using precracked Charpy-type test pieces
No current standard is superseded

UPDATED BRITISH STANDARDS

BS EN 1991-1-3:2003+A1:2015
Eurocode 1. Actions on structures. General actions. Snow loads.
AMENDMENT 1

BS EN 1993-1-4:2006+A1:2015
Eurocode 3. Design of steel structures. General rules. Supplementary rules for stainless steels
AMENDMENT 1

BS EN ISO 3266:2010+A1:2015
Forged steel eyebolts grade 4 for general lifting purposes
AMENDMENT 1

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

NA+A1:2015 to BS EN 1993-1-4:2006+A1:2015
UK National Annex to Eurocode 3. Design of steel structures. General rules. Supplementary rules for stainless steels
AMENDMENT 1

BRITISH STANDARDS UNDER REVIEW

BS EN 10067:1997
Hot rolled bulb flats. Dimensions and tolerances on shape, dimensions and mass

BS EN 10131:2006
Cold rolled uncoated and zinc or zinc-nickel electrolytically coated low carbon and high yield strength steel flat products for cold forming. Tolerances on dimensions and shape

BS EN 10140:2006
Cold rolled narrow steel strip. Tolerances on dimensions and shape

BS EN 10143:2006
Continuously hot-dip coated steel sheet and strip. Tolerances on dimensions and shape

BS EN 10162:2003
Cold rolled steel sections. Technical delivery conditions. Dimensional and cross-sectional tolerances

NEW WORK STARTED

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

EN ISO 11126-3
Preparation of steel substrates before application of paints and related products. Specifications for non-metallic blast-cleaning abrasives. Copper refinery slag
Will supersede BS EN ISO 11126-3:1998

EN ISO 11126-4
Preparation of steel substrates before application of paints and related products. Specifications for non-metallic blast-cleaning abrasives. Coal furnace slag
Will supersede BS EN ISO 11126-4:1998

EN ISO 11126-5
Preparation of steel substrates before application of paints and related products. Specifications for non-metallic blast-cleaning abrasives. Nickel refinery slag.
Will supersede BS EN ISO 11126-5:1998

EN ISO 11126-6
Preparation of steel substrates before application of paints and related products. Specifications for non-metallic blast-cleaning abrasives. Iron furnace slag
Will supersede BS EN ISO 11126-6:1998

EN ISO 11126-7
Preparation of steel substrates before application of paints and related products. Specifications for non-metallic blast-cleaning abrasives. Specification for fused aluminium oxide
Will supersede BS EN ISO 11126-7:2001

EN ISO 17640
Non-destructive testing of welds. Ultrasonic testing. Techniques, testing levels, and assessment
Will supersede BS EN ISO 17640:2010

NA to BS EN 1991-2
UK National Annex to Eurocode 1. Actions on structures. Traffic loads on bridges
Will supersede NA to BS EN 1991-2:2003

NA to EN 1993-1-5
UK National Annex to Eurocode 3. Design of steel structures. Plated structural elements

ISO 6930
High yield strength flat steel products for cold forming

ISO PUBLICATIONS

ISO 6935-2:2015
(Edition 3)
Steel for the reinforcement of concrete. Ribbed bars
Will not be implemented as a British Standard

ISO/TS 19397:2015
Determination of the film thickness of coatings using an ultrasonic gage
Will not be implemented as an identical British Standard

AD 396:
Tying resistance of flexible end plates in one-sided connections

When calculating the resistance of a flexible end plate under a tying force, the design checks in the Green Books (Check 11 in SCI P212, 2009 and Check 11 in SCI P358, 2014) assume in every case that the end plate will deform in double curvature bending, as shown in Figure 1.

The assumption that the end plate is in double curvature bending may be recognised by the form of the resistance equations; for P358 it can be compared to the expressions in Table 6.2 of BS EN 1993-1-8:2005. The equations are from the part of the table covering situations when prying forces may develop – i.e. the plate resistance is determined assuming double curvature bending.

When end plates are connected to a hollow section, or to one side (only) of a web, the assumption that prying can develop appears optimistic. As shown in Figure 2, the end plate may separate from the supporting member, and no prying occurs. In these circumstances, the expressions in Table 6.2 of BS EN 1993-1-8:2005 for "No prying" would appear to be more appropriate, which would mean a considerable reduction in resistance.

SCI have completed a series of Finite Element analyses investigating the behaviour of one-sided connections to webs and connections to hollow sections. The study found that when the supporting element (web or hollow section wall) is relatively thin, no prying occurs. Despite there being no prying force, the resistance calculated assuming prying occurs is still conservative. The study showed that there is considerable yielding of the plates around the bolt, due to the clamping action between bolt head and nut. This yielding is ignored in the simple expression presented in the Eurocode for the "no prying" situations.

The study concluded that it remains appropriate to use the rules in the Green Books (which assume prying and double curvature bending) in all circumstances when calculating the tying resistance of a flexible end plate.

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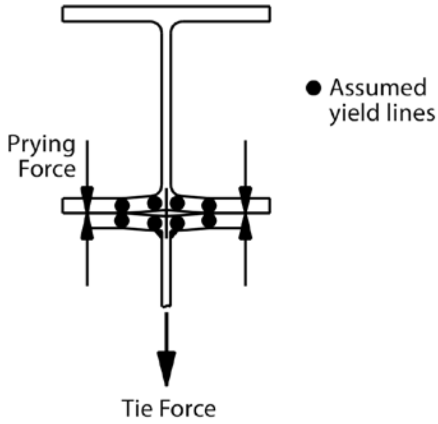


Figure 1: Assumed behaviour of an end plate under a tying force

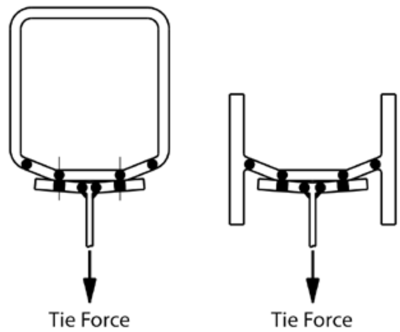


Figure 2: Behaviour in one-sided connections to webs and hollow sections

FROM BUILDING WITH STEEL NOV 1965

Special steel dock for aircraft tail

The huge steel framed hangar built to house VC10 jets of the British United Airways' fleet was one of the major buildings completed at Gatwick this year. It was described in Vol 3, No 5 of *Building with Steel* (and in this section of *NSC* Vol 13, No 1 forty years later). The hangar incorporates a number of interesting features including 191 ft. cantilever roof truss girders which allow for an exceptionally large unobstructed area of floor space.

A tail dock of original design has now been constructed against the rear wall of this hangar to facilitate servicing of the tail plane, elevators, fin, rudder and port and starboard engines of an aircraft, all of which are a considerable height above floor level. The design of the dock is such that all of these vital parts can be inspected and serviced at the same time.

Composition of the dock

The dock comprises three structures, a central fixed unit and retractable port and starboard units. Integral with each retractable unit are two cantilevered catwalks which encircle half the rear end of the aircraft and completely encircle it when both units are brought together.

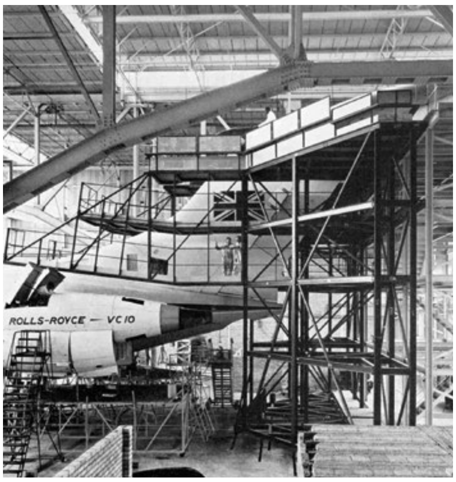
The fixed unit is mostly constructed from 6 in. by 6 in. stanchions and 7 in. by 4 in. beams, braced with rectangular hollow sections (RHS) of various sizes: these were fabricated throughout as single items for site bolted connections. The framework of retractable units is of similar dimensions: the catwalks are fabricated from RHS sections delivered as a fully-welded unit complete with guard rails and ready for bolting to the main frame. A feature of the cantilevers is the provision of hinged flaps in the floor at each level which allow the rudder operation to be checked while the whole tail plane is fully enclosed by the dock. Each of the three units is designed to carry loads of up to 80 lb./sq. ft.

Immense size

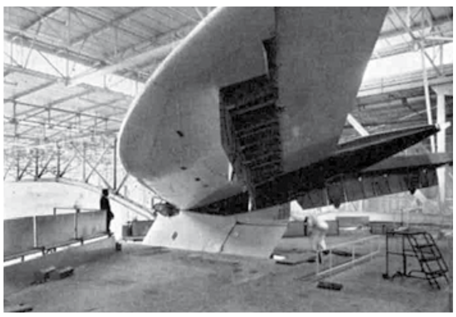
Some idea of the size of the dock may be gained from the fact that the fixed unit weighs 14 tons and has a base area of 50 ft. long by 15 ft. wide and is 35 ft. high: it has four flights of steps. The first two flights terminate at a landing at the 18 ft. catwalk level: the third flight is from the 18 ft. level to the 25 ft. catwalk level. The function of these two platforms is to provide direct access to the two cantilever catwalks on the retractable units. The fourth flight of stairs leads to the 35ft. level giving access to the top platform of the reatractable units.

Each retractable unit weighs 8 tons and on the base frame there is a series of rigid castors allowing movement of the units along metal tracks laid flush with the floor. Each unit is capable of up to 11 ft. sideways movement by hand-operated 2 in. diameter lead-screws, accurate alignment parallel to the front of the fixed unit being ensured.

For servicing purposes the aircraft enters the hangar tail first and is brought up to the fixed unit. Then, in a matter of minutes, the retractable units are moved in from the sides until the two sets of catwalks completely encircle the rear of the machine.



This tail dock was prodced as the result of a combined effort by British United Airways' engineers and the design staff of the steelwork fabricators.



Steelwork contractors for buildings

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

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

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

- **C** Heavy industrial platework for plant structures, bunkers, hoppers, silos etc
- **D** High rise buildings (offices etc over 15 storeys)
- **E** Large span portals (over 30m)
- **F** Medium/small span portals (up to 30m) and low rise buildings (up to 4 storeys)
- **G** Medium rise buildings (from 5 to 15 storeys)
- **H** Large span trusswork (over 20m)
- **J** Tubular steelwork where tubular construction forms a major part of the structure
- **K** Towers and masts
- **L** Architectural steelwork for staircases, balconies, canopies etc
- **M** Frames for machinery, supports for plant and conveyors
- **N** Large grandstands and stadia (over 5000 persons)
- **Q** Specialist fabrication services (eg bending, cellular/castellated beams, plate girders)
- **R** Refurbishment
- **S** Lighter fabrications including fire escapes, ladders and catwalks
- **FPC** Factory Production Control certification to BS EN 1090-1
  - 1 – Execution Class 1
  - 2 – Execution Class 2
  - 3 – Execution Class 3
  - 4 – Execution Class 4
- **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	01509 556677				●	●	●	●		●	●			●	●	✔	3	Silver	Up to £2,000,000
Adstone Construction Ltd	01905 794561			●	●	●	●									✔	2	Silver	Up to £3,000,000
Advanced Fabrications Poyle Ltd	01753 653617				●	●	●	●	●	●	●				●	✔	2		Up to £800,000
AJ Engineering & Construction Services Ltd	01309 671919			●	●					●	●			●	●	✔	4		Up to £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			●	●	●	●			●	●			●	●	✔	4		Up to £800,000
ASME Engineering Ltd	020 8966 7150				●	●				●	●			●	●	✔	3	Gold	Up to £2,000,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●	●	●				●			●	●	✔	2		Up to £1,400,000
Austin-Divall Fabrications Ltd	01903 721950			●	●		●	●		●	●			●	●	✔	2		Up to £800,000
B D Structures Ltd	01942 817770			●	●	●	●				●	●		●		✔	2		Up to £800,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●				✔	4		Up to £1,400,000
Barnshaw Section Benders Ltd	0121 557 8261												●			✔	4		Up to £2,000,000
BHC Ltd	01555 840006	●	●	●	●	●	●	●			●	●		●	●	✔	4		Above £6,000,000
Billington Structures Ltd	01226 340666		●	●	●	●	●	●	●	●	●	●		●	●	✔	4	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 £4,000,000
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 £1,400,000
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 £1,400,000
Gregg & Patterson (Engineers) Ltd	028 9061 8131			●	●	●	●	●				●		●		✔	3		Up to £3,000,000
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 £40,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●					●		●			4		Up to £6,000,000*
John Reid & Sons (Strucsteel) Ltd	01202 483333		●	●	●	●	●	●	●	●	●	●		●	●	✔	4		Up to £6,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445			●	●	●	●	●	●	●	●	●		●	●	✔	4	●	Up to £3,000,000
Kloeckner Metals UK Westok	0113 205 5270												●			✔	4		Up to £6,000,000
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●					✔	2	○	Up to £6,000,000
Legge Steel (Fabrications) Ltd	01592 205320			●	●		●		●	●	●			●	●		3		Up to £800,000
Luxtrade Ltd	01902 353182									●	●				●	✔	2		Up to £800,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●				●	✔	4		Up to £2,000,000
M J Patch Structures Ltd	01275 333431				●	●				●	●				●	✔	2		Up to £800,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●		3		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	01579 383131				●					●	●			●	●	✔	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
Sean Brady Construction Engineering Ltd	00 353 49 436 4144			●	●	●	●			●	●			●	●		2		Up to £800,000
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 £400,000
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*
Underhill Engineering & Building Services Ltd	01752 752483				●		●	●	●	●	●			●	●	✔	4		Up to £3,000,000
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
A Lamb Associates Ltd	01772 316278
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
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
AJN Steelstock Ltd	01638 555500								●		M	
Albion Sections Ltd	0121 553 1877	●									M	
Arcelor Mittal Distribution - Scunthorpe	01724 810810								●		D/I	
AVEVA Solutions Ltd	01223 556655		●								N/A	
Ayrshire Metals Ltd	01327 300990	●									M	
BAPP Group Ltd	01226 383824									●	M	
Barrett Steel Services Limited	01274 682281								●		M	
Behringer Ltd	01296 668259					●					N/A	
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	
Dent Steel Services (Yorkshire) Ltd	01274 607070								●		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			Gold	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●	●	●	●	●	●	●	●	✓	4		✓		Up to £4,000,000
Cairnhill Structures Ltd	01236 449393	●	●	●	●			●	●	✓	4		✓	Silver	Up to £3,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	✓	4	✓	✓	Gold	Above £6,000,000*
Donyal Engineering Ltd	01207 270909	●						●	●	✓	3		✓	Member	Up to £1,400,000
Four-Tees Engineers Ltd	01489 885899	●	●	●	●		●	●	●	✓	3		✓	Member	Up to £2,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445	●		●				●	●	✓	4		✓	Gold	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		✓	Silver	Up to £2,000,000
Severfield (UK) Ltd	01204 699999	●	●	●	●	●	●	●	●	✓	4		✓	Gold	Above £6,000,000
Taziker Industrial Ltd	01204 468080	●						●	●	✓	3	✓	✓		Above £6,000,000
Underhill Building & Engineering Services Ltd	01752 752483	●	●	●	●			●	●	✓	4				Up to £3,000,000
Non-BCSA member															
Allerton Steel Ltd	01609 774471	●	●	●	●				●	✓	4		✓		Up to £4,000,000
Centregreat Engineering Ltd	029 2046 5683	●	●	●	●		●	●	●	✓	4				Up to £800,000
Cimolai SpA	01223 836299	●	●	●	●	●	●	●	●	✓	4				Above £6,000,000
Concrete & Timber Services Ltd	01484 606416	●	●	●	●	●	●		●	✓	4			Member	Up to £800,000
Francis & Lewis International Ltd	01452 722200							●	●	✓	2		✓	Gold	Up to £2,000,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456	●	●	●	●	●		●	●	✓	3				Up to £2,000,000
HS Carlsteel Engineering Ltd	020 8312 1879	●	●					●	●	✓	3		✓		Up to £400,000
IHC Engineering (UK) Ltd	01773 861734	●							●	✓	3		✓		Up to £400,000
Interserve Construction Ltd	020 8311 5500							●	●	✓	N/A				Above £6,000,000*
Lanarkshire Welding Company Ltd	01698 264271	●	●	●	●	●	●	●	●	✓	4	✓		Member	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			Silver	Above £6,000,000

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM
Duggan Profiles & Steel Service Centre Ltd	00 353 56 7722485	●							●		M	
easi-edge Ltd	01777 870901							●			N/A	●
Fabsec Ltd	0845 094 2530	●									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	●
Kloeckner Metals UK	0113 254 0711								●		D/I	
Lindapter International	01274 521444									●	M	
Longs Steel UK Ltd	01724 404040				●						M	
MSW UK Ltd	0115 946 2316	●									D/I	
Murray Plate Group Ltd	0161 866 0266								●		D/I	
National Tube Stockholders Ltd	01845 577440								●		D/I	
Peddinghaus Corporation UK Ltd	01952 200377					●					N/A	
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	●
StruMIS Ltd	01332 545800		●								N/A	
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	
Tension Control Bolts Ltd	01948 667700						●			●	M	
Trimble Solutions (UK) Ltd	0113 887 9790		●								N/A	
voestalpine Metsec plc	0121 601 6000	●									M	●
Wedge Group Galvanizing Ltd	01909 486384						●				N/A	
Yamazaki Mazak UK Ltd	01905 755755					●					N/A	