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NSC

London market revived

January 2015
Vol 23 No 1

Steel approaches Forth

Electrifying the Great Western

Glasgow plaza rises

New crossing for Deptford

Cover Image
Forth Replacement Crossing approach viaducts
Main client: Transport Scotland
Structural engineer: Ramboll
Steelwork contractor: Cleveland Bridge
Steel tonnage: 8,500t

BCSA

TATA STEEL

SCI Steel Knowledge

January 2015 Vol 23 No 1

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

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ONE STEP AHEAD.

Early involvement can boost sustainability

Nick Barrett - Editor

Last January we were looking ahead to a gathering of pace of a still nascent recovery in the demand for constructional steelwork and construction products and services generally. A year later those hopes are being realised and the pace of growth in demand is continuing into the New Year.

Growth following a recession brings its own problems however, and the press is full of stories about shortages of materials like bricks and concrete and of professional and trade skills. Skilled trades are in desperately short supply in places and £1,000 a week for a bricklayer seems to be commonplace.

Clients can avoid a lot of supply chain stresses and strains however, as BCSA Director General Sarah McCann-Bartlett points out in this month's News, by choosing to work more collaboratively with their steelwork contractors, and tapping into their wealth of accumulated design and construction experience by getting them on board earlier in the pre construction phases.

Project planning and coordination can only be improved by early involvement of steelwork specialists. Many clients already know this and value the contribution they can make, but others seem to pay lip service to the idea and don't achieve the time and money savings that assembling a project team early with intimate knowledge of how to maximise the huge benefits of steel brings.

Early involvement of the steelwork contractor also has sustainability benefits, as was stressed at the SCI's event at the London Transport Museum as you can also read about in News. Steelwork contractors are well placed to give timely advice on achieving an economic and structurally efficient, as well as cost efficient, design, as William Hare's Jonathan Davis explained.

There are many benefits from getting your steelwork contractor, and other specialists, on board as early as possible. There are also benefits from ensuring that your steelwork contractor is a member of the BCSA, not the least of which will be that you can sure that all the modern high standards in health and safety procedures will be followed, both on site and in the fabrication workshop.

Steel supplied by a BCSA member will be CE Marked and its operational procedures will be audited as a condition of membership, giving clients, Tier 1 contractors, designers and other construction team members assurance that they are working with a quality assured, highly skilled and experienced steelwork supplier.

All this will continue to be available in 2015 without the price spikes, materials shortages and increasing lead times that currently bedevil other materials, although slow and steady price increases are expected. The steel construction sector has plenty of capacity to help its clients manage the continuing economic recovery without undue stresses.

NSC

EDITOR
Nick Barrett Tel: 01323 422483
nick@newsteelconstruction.com
DEPUTY EDITOR
Martin Cooper Tel: 01892 538191
martin@newsteelconstruction.com
CONTRIBUTING EDITOR
Ty Byrd Tel: 01892 553143
ty@barrett-byrd.com
PRODUCTION EDITOR
Andrew Pilcher Tel: 01892 553147
admin@newsteelconstruction.com
PRODUCTION ASSISTANT
Alastair Lloyd Tel: 01892 553145
alastair@barrett-byrd.com
NEWS REPORTER
Mike Walter
COMMERCIAL MANAGER
Fawad Minhas Tel: 01892 553149
fawad@newsteelconstruction.com

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The British Constructional Steelwork Association Ltd
4 Whitehall Court, Westminster, London SW1A 2ES
Telephone 020 7839 8566 Fax 020 7976 1634
Website *www.steelconstruction.org*
Email *postroom@steelconstruction.org*

Tata Steel
PO Box 1, Brigg Road, Scunthorpe,
North Lincolnshire DN16 1BP
Telephone 01724 405060
Website *www.tatasteelconstruction.com*
Email *construction@tatasteel.com*

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

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

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BCSA CRAFT scheme will reverse skills shortage

To alleviate a nationwide skills shortage in the steel construction sector, the British Constructional Steelwork Association (BCSA) has launched an apprenticeship scheme for its membership covering all aspects of steel fabrication.

Known as the Competence Route of Attainment in a Fabrication Trade (CRAFT), the scheme is proving to be successful as there are currently 14 apprenticeships enrolled with more pending.

"We all know there has been a problem getting skilled workers, but nothing was available that addressed the needs of our industry," said BCSA Director of Health, Safety and Training, Peter Walker.

"A survey of members in 2011 revealed that less than 2% of BCSA members employees were apprentices and most of the 2% was from the larger member companies."

CRAFT is a scheme based on the traditional apprenticeships that many people in the industry are familiar with. However instead of employees being sent to a training centre a few days a week, this scheme enables someone new to the industry to be trained and developed over a minimum of two years at the workplace, using the company specific systems and equipment.

"There aren't enough training centres available for our specific needs," added Mr Walker. "So by training apprentices in-house we bypass this problem, while the employer gets to see the person being trained and see his/her continual development in the workplace."

There are a number of recommended training modules in the CRAFT scheme for a fabricator/welder, fabricator or welder. They are detailed in the table to the right.

For more information on the CRAFT scheme contact Peter Walker, Tel: 07970 463420 or pete.walker@steelconstruction.org

Module	Trade Skill	Fabricator/ Welder	Fabricator	Welder
A	Health and Safety	✔	✔	✔
B	Weld Fume Hazards	✔	✔	✔
1	Reading Drawings and Material Sizes	✔	✔	
2	Marking Out for Fabrication	✔	✔	
3	Shearing Plates and Sections	✔	✔	
4	Oxygen Flame Cutting	✔	✔	✔
5	Hand Held Grinding and Cutting	✔	✔	✔
6	Arc Welding	✔		✔
7	Assembling Structural Steelwork	✔	✔	
8	Metal Active Gas (MAG) Welding	✔	✔	✔
9	Submerged Arc Welding (SAW)			✔
10	Drilling	✔	✔	
17	Visual Weld Inspection	✔		✔
18	Weld Imperfections	✔		✔
External	BS EN 9606-1 MAG 135 Flux Cored 136	✔		✔
External	Slinging and Lifting Components	✔	✔	✔

Modern offices take shape behind protected façade

A new office and retail scheme on London's famous Regent Street is taking shaped behind two retained façades.

The project at 169-183 Regent Street and also known as block W5 is bounded by New Burlington Street to the south and New Burlington Place to the north.

A number of interlinked buildings have been demolished to make way for a new open-plan six-storey office block that will sit above a ground floor retail zone with two basement levels.

The two main façades along Regent Street and New Burlington Street are being retained, with the latter also incorporating two 300-year old listed buildings that are being renovated as part of the overall project. The façades are protected by hoardings that resemble the completed scheme.

A steel frame is creating the new structure with Severfield erecting a total of 1,800t to complete its package. Using one centrally positioned core for its stability, the steelwork is based around an irregular grid with internal spans varying from 11.5m up to 16.5m.

Access to the site is a major challenge for the construction team, as the majority of the project's footprint will be built on.

"Logistics and planning are key drivers on this project," explains Mace Project Director, Steve Hawthorne. "We have one laydown area along New Burlington Street which we use for deliveries such as steelwork. Because of the lack of onsite space all steelwork has to be delivered on a just-in-time basis, which means it's lifted off the trucks and erected straightaway."

Steel brick walls will aid nuclear construction

Steelwork contractor Caunton Engineering is pioneering a new steel walling system that could radically alter the way nuclear power stations are built.

The Government is backing the product with nearly £1M in funding from Innovate UK, the newly-named Technology Strategy Board.

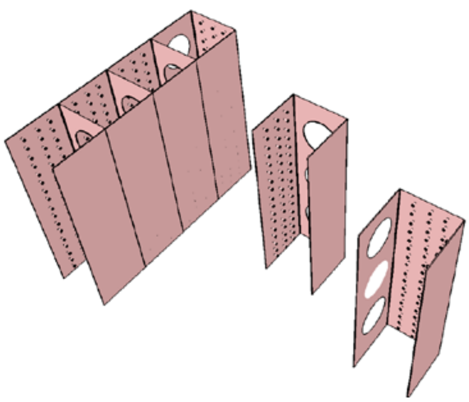
The basic design concept was developed by a Glasgow-based modular walling system company, which then worked with the Steel Construction Institute and Caunton Engineering to refine the product in advance of building the first major sections.

Caunton is now one of a handful of construction companies that have won R&D funding to develop nuclear technologies.

Use of these factory-made steel bricks could pave the way for large sections of nuclear power stations to be built off-site.

This would speed up construction, improve build quality and reduce project risk.

Innovate UK Chief Executive Iain Gray said: "The product will help our civil nuclear industry set new standards."



SCI members day focuses on sustainability

SCI Chief Executive, Graham Couchman opens the event

'A step change in sustainability' was the theme of the latest Steel Construction Institute (SCI) annual event held at the London Transport Museum.

The guest speakers were University of Cambridge Professor of Engineering and the Environment, Julian Allwood (top right) and William Hare Senior Design Engineer Jonathan Davis (bottom right), who both posed the question, 'is sustainability achievable and do we need it?'

Professor Allwood's speech was entitled 'Adding more value with less new steel' which focussed on a number of issues such as more reuse of structural steelwork and designing buildings with longer lifespans.

"Steelmaking accounts for approximately 25% of industrial carbon emissions and future demand for the material is expected to double by 2050," said Professor Allwood. "Consequently the industry needs to look at better utilisation of materials and more cost efficient designs."

Better use of temporary steel structures was mooted as a good idea by Professor Allwood as was the dismantling and reusing of supermarket buildings once their regular lifespan, which is usually 20 years, has been reached.

'Economic and efficient design – the steel contractor's view' was the title of the address delivered by William Hare's Jonathan Davis.

He stressed getting the steel design correct and cost efficient, while making sure the scheme was right for the design was always key.

"The optimisation of fire protection is also one of the most important steel design considerations," said Mr Davis.

The event concluded with a question and answer session and the SCI AGM.

New City landmark will include Roman exhibition space

Steel construction is progressing on schedule for the new London headquarters for international media company Bloomberg.

The scheme will include some retail units at ground floor level and a new entrance to the Bank London Underground Station. Bloomberg London will also host a permanent public exhibition on the Roman Temple of Mithras which was originally unearthed on the site in the 1950s.

Two office buildings, offering approximately 47,800m^2 and 21,300m^2 respectively, dominate the site, separated by new public spaces and linked by two sky bridges.

The project has been designed by Foster + Partners and the steelwork contractor is William Hare.

NEWS IN BRIEF

The first roof panels have been lifted into place as the conversion of London's former **Olympic Stadium** gathers pace. Approximately 10,000 panels will be fitted over the next few months, work which follows on from the installation of eight kilometres of cabling and 112 steel rafters, the longest of which is 38m. At 84m at its deepest point the new roof is believed to be the largest cantilevered roof in the world.

Tata Steel has extended its Trisomet metal cladding range with a 135mm panel that meets the latest Scottish Technical Standard (Section 6) and its 0.15W/m^{2}K U-value requirement. The panel is available in lengths of up to 20m and has a thicker core which gives increased performance. For details visit www.tatasteelconstruction.com or Tel: 01244 892130 .

Metsec has won the accolade of being named "Best Business of the Year" at this year's Business is Good for the Black Country Awards. Metsec Managing Director, Neil Richardson said: "We are proud that the judges were inspired by our investment in people, processes and equipment. As an organisation, we work hard to continuously offer all our employees and young engineers the best possible career development and training opportunities across our business divisions to ensure future excellence.

Graitec has announced the coming together of its three UK companies, Adris, MicroCAD and Graitec UK into one company known as Graitec. Following on from the acquisition of MicroCAD earlier this year and the joining of Graitec UK and Adris it has been decided to formalise these companies into one UK entity.

Newport Galvanizers (part of Wedge Group) has galvanized a 40t spider sculpture that makes up the main attraction for Bristol-based Arcadia Spectacular's dynamic and unique shows that incorporate music, pyrotechnics, laser shows, and aerial performances. The plant was called upon to galvanize the steel feet of the spider.

AROUND THE PRESS

New Civil Engineer
27 November 2014
Importance of carbon calculation

"The steel industry promotes the whole life approach to embodied carbon calculation," says John Dowling, British Constructional Steelwork Association sustainability manager.

New Civil Engineer
27 November 2014
City centre landmark

[St Vincent Plaza, Glasgow] "This is a speculative office development and getting the completed building onto the market as quickly as possible was very important to the client. So a fast track construction programme was essential and steel was the best option for this," says Keppie Design Architect, Richard MacDonald,

Construction News
21 November 2014
ISG uses 'Toblerone' beams on unique HQ

[TPP Headquarters, Leeds] – With the client specifying big, open floor plates throughout the building, the design immediately pointed towards a steel frame to accommodate the larger spans.

The Structural Engineer
November 2014
Composite and steel construction compendium

Where column-free spaces are required and integration of the structural and services zones is important, long span solutions based on beams with web openings are a popular choice.

Building Magazine
3 October 2014
Shored up

[RNLI centre, Poole] – Above ground the building proceeds in a more conventional manner. It comprises a three span steel portal frame that houses two barrel roof building volumes separated by a covered central courtyard,

Sub-contractors call for safe ground conditions

The British Constructional Steelwork Association (BCSA), the Structural Timber Association (STA) and the National Federation of Builders have joined forces to call for safer ground conditions on construction sites.

Sarah McCann-Bartlett, Director General of the BCSA said 'Ground conditions is an area where a matter of a few inches could be the difference between life and death for site workers. We were very lucky that we had a dry start to Autumn. But those weather conditions did not last and with the rain comes softer ground and danger.'

The Strategic Forum Plant Safety Group has published the 'Good Practice Guide for Ground Conditions for Construction Plant' that provides guidance for all those working in the construction sector.

" The aim of the Guide is to prevent accidents and save lives by ensuring that ground conditions are suitable for heavy lifting equipment used by sub contractors on construction sites,' said Paul Bogle, Head of Policy and Research, National Federation of Builders.

The HSE has also revised its guide 'The Selection, Management and Use of Mobile Elevating Work Platforms' (Series code: GEIS6), which outlines the responsibilities of those in control of the site and the users of the equipment.

The Good Practice Guide for Ground Conditions for Construction Plant can be downloaded from: www.cpa.uk.net/sfpsg/

Download 'The Selection, Management and Use of Mobile Elevating Work Platforms' from: www.hse.gov.uk/pubns/geis6.htm

Steel industry website updated with BIM section

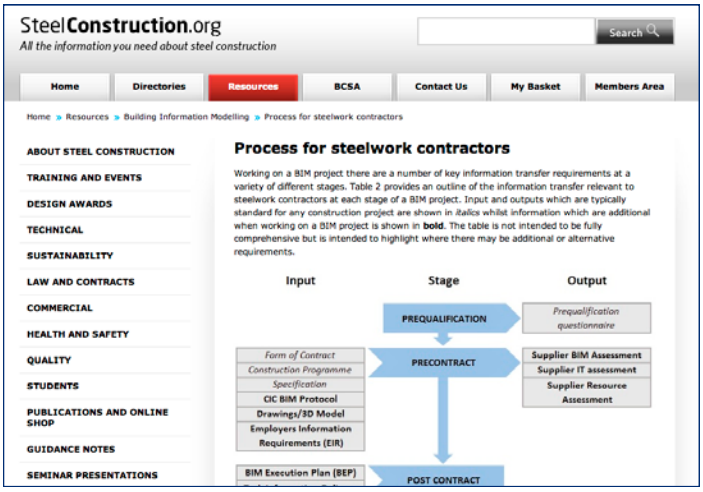
The BCSA's www.steelconstruction.org website has been updated with the addition of a comprehensive section on Building Modelling Information (BIM).

"Many people in the industry consider BIM to be just 3D modelling, whereas it is much more," said BCSA Director of Engineering, Dr David Moore. "The new web pages give a thorough and practical explanation of BIM aimed at steelwork contractors and those companies that deal with steelwork contractors."

On a typical BIM construction project there are a number of key information transfer requirements at a variety of different stages in the construction process.

The web pages provide an outline of the information relevant to steelwork contractors at each stage of a BIM project.

"The BCSA reviewed the main BIM inputs and outputs required at each stage of the process and developed a series of examples and supporting information to help members understand the BIM process, complete the various BIM questionnaires and help define the information that the steelwork contractor is required to provide," added Dr Moore.



To supplement the new web pages the BCSA has issued a glossary of BIM relevant terms.

Tata Steel future proofs its roofing system

Tata Steel has announced that the Confidex Guarantee for Colorcoat HPS200 Ultra, the company's roof and wall cladding pre-finished steel product, has now been extended to include cover for areas that are situated under photovoltaic (PV) frame modules.

This means the whole building envelope is guaranteed to perform for the same duration of up to 40 years, giving building owners who wish to install PV modules the assurance that it will not have a detrimental effect on the performance of the pre-finished steel underneath.

"With the trend for decreasing photovoltaic costs, and local authorities in the UK incorporating them as part of their supplementary planning guidance, they are becoming much more attractive to install on the roof of a building," said Tata Steel Manager New Product Development, Peter Barker.

"This has led to questions from our customers as to the effect this has on the roof building material guarantee. Based on our assessment of current building stock and accelerated weathering test results, we have been able to extend the Confidex guarantee."

He added; "If the building owner is considering retrofitting photovoltaics in the future, specifying Colorcoat HPS200 Ultra also ensures that the roof is PV ready, allowing modules to be installed at any point throughout the Confidex Guarantee Period, providing it was registered, and ensures that the performance of the pre-finished steel over the entire roof will still be covered for the remainder of the guarantee duration. It also includes full reparation in the unlikely event of the pre-finished steel failure."

Steel tower given go ahead in Plymouth

Plans have been approved by Plymouth City Council for a £26M 22-storey high student accommodation scheme which on completion will be the city's tallest building.

The 78m-high steel-framed structure, designed by Boyes Rees Architects, has been developed in consultation with Plymouth City Council, which has a policy to encourage more tall buildings in the city centre.

The site is in a prominent location, at the northern end of Armada Way, facing onto the junction of Cobourg Street and Western Approach.

A spokesperson for Boyes Rees Architects said a steel framed solution for the building was chosen as it offered the quickest and most efficient construction programme.

The building will be operated by The Student Housing Company, which already operates the Astor House building in the city that opened in 2013 and is currently home to 519 students of Plymouth University.

Work on the project is expected to begin early this summer.

Supply chain relationships critical in rising market says the BCSA

As the construction industry continues to gather pace and demand for sub-contractors increases, relationships between clients, main contractors and their supply chain have become even more critical, according to the British Constructional Steelwork Association's (BCSA) Director General, Sarah McCann-Bartlett.

"While structural steelwork contractors in the UK have sufficient capacity to meet increased demand from the construction industry, by working more collaboratively clients and main contractors can get better outcomes from the structural steelwork supply chain," said Ms McCann-Bartlett.

The BCSA urges clients and main contractors to engage with the steelwork contractor early as this allows them to contribute to programme planning and project coordination.

Contractors should also work with the steelwork specialist early in the project to capture its design expertise and knowledge, as well as ensuring that the design team releases information in a form and sequence that coordinates with the steelwork package

Ms McCann-Bartlett said that main contractors should use a BCSA Member company to ensure compliance with CE marking, health & safety, and other regulatory requirements.

"Supply of structural steel in our market is well balanced, and while we are seeing a rise in prices this will continue to be slower than some other construction products where we're seeing shortages, much longer lead times and price spikes," she added.

Industrial strategy for metals focuses on meeting future client needs

A future vision for UK industry has been set out by the Government through its Industrial Strategy framework which also includes the Industrial Strategy for Construction.

In response the Metals Forum, the UK's metals sectors have come together to articulate their future vision for metals in the UK with the development of an Industrial Strategy for Metals. This development of the strategy is being supported by the Department of Business, Innovation & Skills.

The Industrial Strategy for Metals will set out future pathways for metals in the UK in areas such as skills, innovation and sustainability. In developing the strategy, industry is working with stakeholders including customers, supply chain partners, the Government and Trade Unions to build the partnership models necessary for long-term success.

The Steering Group for the strategy development is chaired by Jon Bolton from Tata Steel and is overseen by the Metals Forum through its Chairman, Sarah McCann-Bartlett, Director General of the BCSA.

The strategy is being developed through five work streams including:

- Education, Skills & Training
- Supply Chain & Partnerships
- Sustainability
- Communication & Promotion
- Innovation and R&D

The Industrial Strategy for Metals is due to be launched this year.

Diary

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

Tuesday 20 January 2015
Connection Design
1 hour lunchtime webinar free to BCSA and SCI members, offering an overview of connection design.

Tuesday 27 January 2015
Steel Connection Design
This course is for designers and technicians wanting practical tuition in steel connection design. Dublin.
For details click here

Tuesday 10 February 2015
Portal Frames Design - Preliminary Sizing & In-plane Stability
1 hour lunchtime webinar free to BCSA and SCI members, offering an overview of connection design.

Thursday 12 February 2015
Steel Frame Stability
The course provides guidance on braced frames, continuous frames and portal frames. Leicestershire.
For details click here

Approaching a new landmark

The new Forth Crossing requires the construction of two lengthy steel formed approach viaducts which are being incrementally slid into position.

Girder sections are welded together onsite before being launched

The south approach viaduct under way

FACT FILE
Forth Replacement Crossing approach viaducts
Main client: Transport Scotland
Main contractor: Forth Crossing Bridge Contractors (FCBC)
Structural engineer: Ramboll
Steelwork contractor: Cleveland Bridge
Steel tonnage: 8,500t

The largest civil engineering project in Scotland for a generation is under way as the £790M Forth Replacement Crossing begins to take shape.

The new road bridge linking Edinburgh with the county of Fife, and sitting alongside its famous neighbours, the Forth (rail) Bridge and the Forth Road Bridge, will be the longest three tower cable-stayed bridge in the world replacing the current road bridge as the main vehicle crossing of the Forth.

Three towers will rise 207m above high tide sea level from which 23,000 miles of stay cabling will be attached. The bridge will have two 650m-long central spans and two further spans of 223m. Including the approach viaducts and road improvement schemes on either side of the Firth of Forth, the project has a 22km-long footprint.

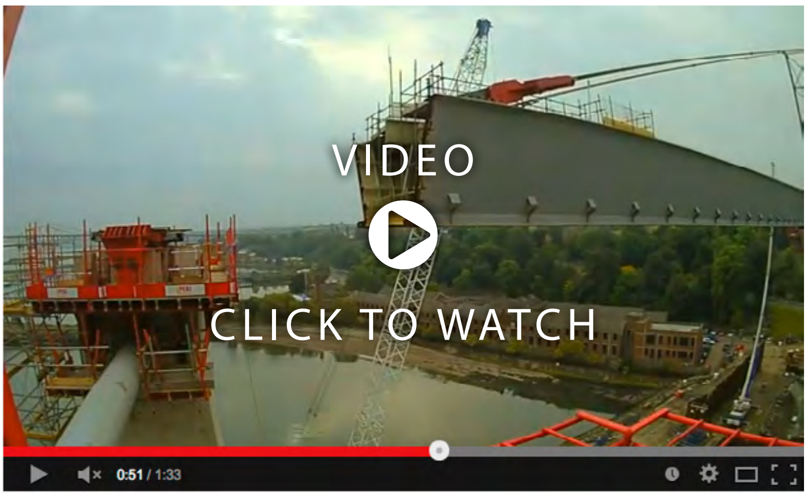
Forth Crossing Bridge Constructors (FCBC), an international consortium consisting of Hochtief Solutions, American Bridge, Dragados & Morrison Construction, is delivering this huge project and has awarded Cleveland Bridge the contract for the fabrication, delivery and site assembly of the two approach viaducts.

Work on the approach viaducts is being done concurrently with the main bridgeworks. The 545m-long southern viaduct steelwork was completed in December (2014) and work has now switched to the north shore with the northern structure scheduled to be finished later this summer.

For the south approach viaduct, the steelwork consists of a total of 38 twin open top trapezoidal box girders, each 8m wide × 4m high and up to 33m long. The girders were fabricated in half sub-assemblies, split longitudinally, at Cleveland Bridge's Darlington factory allowing them to be transported to site by road.

They are then welded up onsite to form the complete girders that in turn were welded into two parallel steel decks for the approach structure. Once steelwork is completed, a concrete deck will be cast to form separate northbound and southbound road decks that will lead on and off the new bridge.

"Offsite construction is playing an important role as, although we do have a lot of onsite welding to do, there would be



a lot more of this time-consuming work if Cleveland weren't prefabricating these large sub-assemblies," says Gabriel Menendez-Pidal, FCBC Head of Section.

Cleveland Bridge initially setup an assembly and delivery yard, complete with an overhead crane, adjacent to the southern viaduct. Sub-assemblies were unloaded onto assembly jigs positioned above a launching track.

Once two halves were welded together to form one complete unit, it welded to another complete girder to form a portion of deck and these are slid into position using incremental launches.

"A total of 12 launches (six on each side) were needed to complete the southern approach," says Stephen Osborne, Cleveland Bridge Operations Manager.

The incremental launch procedure involves a series of welded-up girders, to a combined length of around 100m at a time, being slid from the assembly yard out over the piers. Launching bearings with Teflon pads are used on top of the six pre-prepared concrete piers.

The girders are pulled by a series of strand jacks positioned on an H-frame supported at the south abutment structure.

After each launch, a further series ▸12

"Offsite construction is playing an important role as, although we do have a lot of onsite welding to do, there would be a lot more of this time consuming work if Cleveland weren't prefabricating these large sub-assemblies."

Two lines of girders for the south approach viaduct being readied for another launch

More approach solutions

As well as the Forth Replacement Crossing's two approach viaducts, four other bridge structures are being constructed as part of the scheme's necessary surrounding road improvement works.

Forth Crossing Bridge Contractors (FCBC) has contracted Mabey Bridge to fabricate, supply and erect these structures, a job that is scheduled to be completed in March.

Two of these bridges have been erected on the south shore as part of a new approach interchange carrying the existing A904 over the recently constructed M90 approach road. Each of the identical structures is formed with six 60m-long steel girders that were delivered from Mabey Bridge's Chepstow factory to site as 20m-long braced pairs.

The pairs were welded or bolted into the required 60m lengths in an adjacent assembly area and using a 750t capacity mobile crane, erected as three braced pairs each weighing 160t.

"The inner girders for both structures were bolted, while the outer girders were welded into long lengths for aesthetics," explains Chris Reynolds, Mabey Bridge Site Operations Manager.

Over on the north shore Mabey Bridge has recently completed two more bridges, one of which is the largest structure of the contract.

Known as Structure FT01, the bridge spans the recently constructed B981 road and links the A90 to the new M90 approach carriageway to the new crossing. It incorporates a curving road and so it has a skewed layout whereby the inner span is 80m–long and the outer span is 110m-long.

One of the bridges for the new south shore approach interchange is lifted into place

Requiring 2,000t of structural steelwork, FT01 has been formed with nine rows of trapezoidal boxes, with each box measuring 3.5m high and up to 4.5m wide.

The boxes were brought to site in lengths of 30m, each weighing up to 53t. Once assembled into full bridge lengths weighing up to 180t each, they were lifted into place using a 600t capacity crawler crane.

"The design incorporates trapezoidal boxes as they help keep the overall weight of the structure down for such a long span structure," says Mr Reynolds.

The fourth structure and the third to be erected on the south shore is known as Structure ESQ4, which will carry the B800 over the A90.

This 110m-long replacement bridge spans the existing A90 into Edinburgh and a major utility route. It was delivered to site as nine braced pair sections, weighing up to 75t each.

Once onsite they were lifted into place using a 1,000t-capacity mobile crane.

"Because of the importance of the utility route and the requirement for a night time closure of the main road from the north into Edinburgh, we carried out trial lifts of the three pairs of girders that span the pipeline to ensure the procedure would be faultless," explains Mr Reynolds.

The new bridge will be the third crossing of the Firth of Forth

◀ 11 of girders is attached to the end of the previous launch and the next slide is ready to take place.

Steelwork on the southern approach viaduct has been completed and the entire steel assembly yard and its crane have now been dismantled and transported over to the north shore where a new facility has been setup.

Work is now progressing on the shorter 220m-long north approach viaduct. Its steelwork consists of 12 single open top deck boxes measuring 30m wide × 4m high and around 12m long. At the end of these boxes are eight open top trapezoidal box girders 8m wide × 4m high and 18m long which are fabricated by Cleveland Bridge.

For the north approach viaduct Cleveland Bridge is assembling the entire viaduct behind the north abutment, and once complete the entire structure will be launched into position during one three-day long operation.

"The northern structure is different to the south as the steel boxes will form a single deck structure that attaches to the main bridge, while the final 75m of the viaduct will be the same as the southern viaduct as two parallel decks finishing at the north abutment," explains Mr Osborne.

The north approach viaduct will be supported on two piers and will also be attached to the north tower by cable stays. This approach viaduct is scheduled to be completed and in position later this year.

Swinging into action

FACT FILE
Greenwich Reach Swing Bridge
Developer: Galliard Homes
Architect: Moxon Architects
Main contractor: Raymond Brown Construction
Structural engineer: Flint & Neill
Steelwork contractor: S H Structures
Steel tonnage: 215t

A new cable-stayed swing bridge at Deptford has improved riverfront access for long distance walkers while also taking on board maritime heritage.

The area around Deptford Creek in south London was once one of the nation's most important Naval dockyards, and many famous vessels were built here before the facility closed down in the mid-Nineteenth Century to be replaced by commercial docks.

Today, the docks too have closed down and moved further downstream along the River Thames to Tilbury. However, river traffic is still abundant and consequently many of the new developments springing up along the capital's riverfront have to take this into account.

This has been the case at New Capital Quay, a residential scheme developed by Galliard Homes on the south bank of the Thames adjacent to Deptford Creek.

As part of the development Galliard has been obliged to provide a footbridge that spans the inlet and also opens to allow aggregate barges upstream to the local ready-mix batching plant. Galliard commissioned Raymond Brown Construction to build the new bridge, while Flint & Neill led the design team.

"The development had to increase public access along the Thames riverfront without hindering waterborne traffic entering the creek," says David Knight, Flint & Neill Senior Engineer. "A cable-stayed swing bridge was the solution as it can be swung open by 100 degrees to be completely clear of the river."

The proposals also ensured the project would be sensitive to the local maritime history and to the client's wish for an economical low maintenance structure.

"We then chose a steel design for the bridge as its lightweight qualities would minimise the size of the required M&E equipment," adds Mr Knight.

It has a sculptural form, said to be suggestive of sailing vessels, with folded steel plates that conceal a short 9m backspan containing 120t of steel counterweight. This balances the 44m-long main span as it opens.

The span is opened or driven by four electrical drive motors on a slewing ring bearing system that is more commonly seen on tower cranes.

The structure is predominantly fabricated from weathering steel that negates the requirement for any future internal repainting.

S H Structures fabricated, supplied and erected the steelwork for the job. As the site was accessed through an existing housing scheme and space was at a premium, a lot of planning was needed to work out the best construction sequence as well as the size of steel elements that could be manoeuvred and transported on to site.

"We fabricated and delivered the bridge deck to site in three main sections," explains Dave Perry, S H Structures Contracts Manager. "These were transportable by road albeit with a police escort through London."

The two main span sections were 19m long and up to 5.6m wide as the bridge's width varies with a minimum width of 3.8m. The third piece was the backspan section and this measured 15m long x 5.6m wide and weighed 15t.

Onsite assembly of the bridge was conducted on the bank of the Creek and in a position that was identical to the structure's

Impression of the completed bridge

open position. The backspan was lifted into place first. Using a 300t capacity mobile crane it was lifted onto the slew bearing that had previously been installed into the bridge's foundations.

The two main spans were welded together and then welded to the backspan to form the bridge deck structure.

The tapering 15m-high mast was then brought to site and attached. It consists of a pair of flat 40mm thick plates separated by inclined plate stiffeners. This creates an open transparent structure that acts like a Vierendeel strut in compression.

Using a 70t capacity mobile crane S H Structures then had to attach the cable stays to the mast and make sure they were stressed to the correct tension.

Plated steelwork has also formed the abutment onto which the closed swing bridge rests. This is a 3.5m-high raised platform measuring 4m × 5m and brought to site as one 10t piece.

On the opposite bank a four span steel approach structure is also formed from plates, each weighing 9t and bolted together onsite to form the ramp.

A nine-month construction programme was completed in November and the bridge was opened to pedestrians on completion of the local council adoption.

A bridge section is lifted into place

Bridge is a trailblazer

The Greenwich Reach Swing Bridge has enhanced the Thames Path, the National Trail that opened in 1996 and follows the length of the river from its source in Gloucestershire all the way to the Thames Barrier at Charlton, a distance of 296km.

Previously the Path had to deviate inland at Deptford Creek, through housing estates and over busy roads before reaching Greenwich.

The bridge has closed one of the gaps in the Thames Path, by creating a new and easier route over Deptford Creek and along the River Thames's south bank.

The bridge was constructed in its open position

Keeping the film industry rolling

Steel is playing a leading role in aiding Innovia Films, one of Cumbria's leading employers, to expand its manufacturing facility without disrupting onsite production.

FACT FILE
Innovia Films facility extension, Cumbria
Main client: Innovia Films
Architect: Johnston and Wright Architects
Main contractor: Story Contracting
Structural engineer: A L Daines and Partners
Steelwork contractor: Border Steelwork Structures
Steel tonnage: 250t

The new steelwork connects to the existing steel framed building

Headquartered in Wigton, near Carlisle, Innovia Films is a leading global manufacturer of two speciality products, Biaxially Orientated Polypropylene (BOPP) and cellulose based films and these are supplied into the packaging, labels, tobacco overwrap and securities markets.

The company is currently undertaking a £20M investment package that includes the construction of an additional BOPP production area that will help increase output by up to 10%.

The new facility is a steel framed extension added to the existing BOPP production building. Importantly, all work is being carried out without any interference to the adjacent production processes.

"Our BOPP production process is a 24/7 operation every day of the year and the steel extension is being built in such a way that it doesn't interrupt the work in any way," says Simon Butcher, Innovia Films Senior Design and Development Engineer.

The new steel frame has been bolted on to one end of the existing building. In order to not cause any disruption during the erection process, steelwork contractor Border Steelwork Structures cut openings in the existing building's cladding to allow for each steel beam connection between the new and old frames.

"Once a connection was made we then made sure the hole was watertight before moving onto the next steel connection," explains Stuart Airey, Border Steelwork Structures Senior Contracts Manager.

Keeping the majority of the existing building's cladding system in place during the construction programme created an effective barrier that allowed work to carry on normally within the plant.

The cladding was only removed once the extension was at a watertight stage in its construction process, and then a temporary sheeting system was installed to separate the two areas during the machinery fit-out.

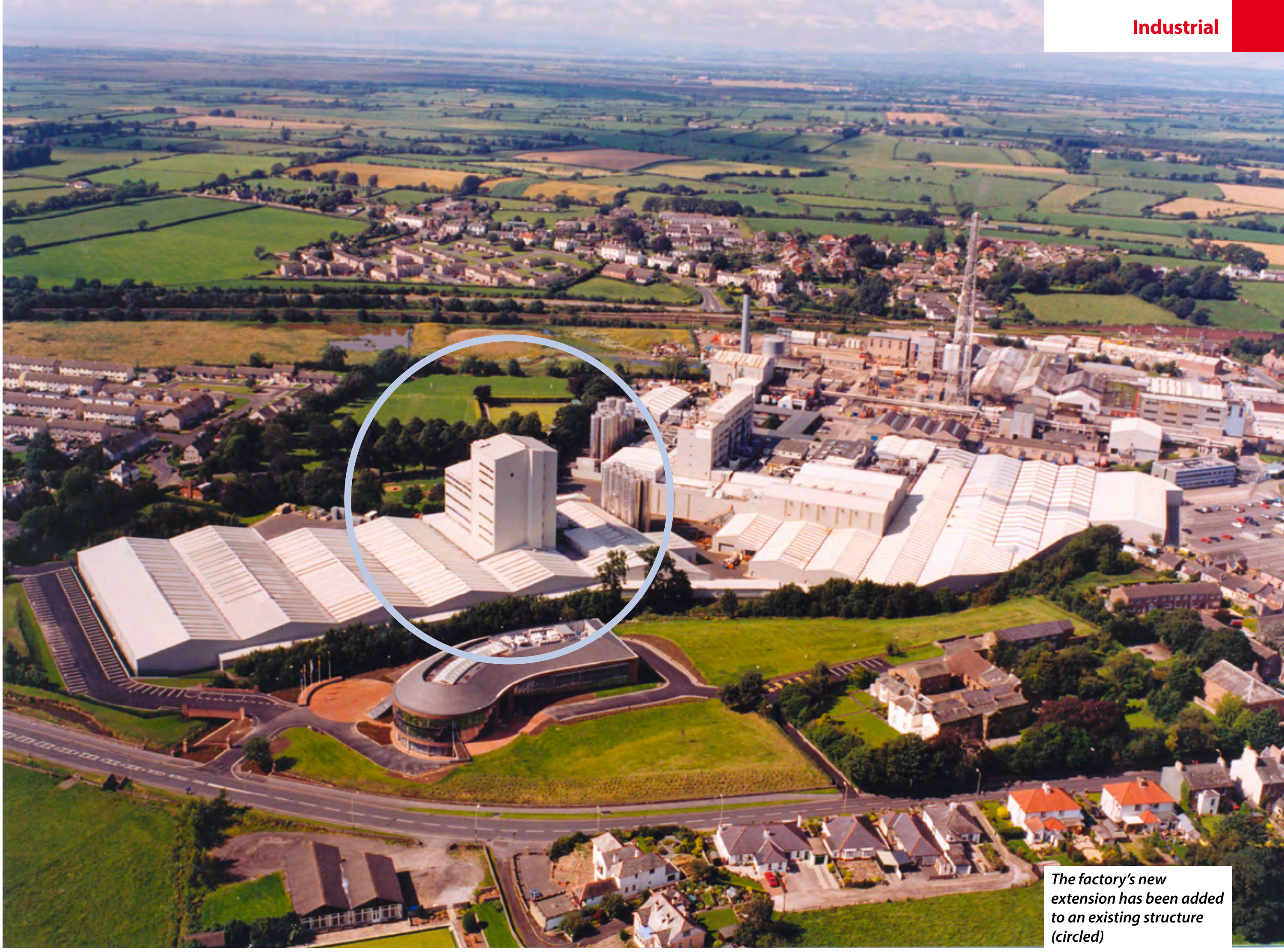
The steel framed extension has been predominantly erected around a 6.7m × 5.1m grid pattern, and measures 22m long × 11m wide and 37m high.

"Basically we've designed the extension as a mirror structure as the column centres and the floors up to level five match the existing building," says Nigel Perry, A L Daines and Partners Project Engineer.

"However it is 3.5m higher than the existing building as we need to accommodate additional equipment for a more up-to-date BOPP production process."

The extra height of the extension also accommodates a series of mezzanine levels and one extra floor and these do not tie-in with the adjoining floors.

This extra floor was added to the design quite late in the day and because of steel's



The factory's new extension has been added to an existing structure (circled)

flexibility it did not hinder the project's progress in any way.

Work on the project started towards the end of 2013 and initially main contractor Story Contracting had to partially demolish an office block to make room for the production extension.

A 7m wide low level area of the new build now connects into the remaining part of this office block via an existing glazed atrium.

Once the preparatory work had been completed Border Steelwork Structures began its 34-week steelwork and cladding programme.

One mobile crane and, because of the building's height, two 42m reach MEWPs were used for Border's entire programme.

The extension is a steel braced frame, gaining its longitudinal stability from the existing frame, with additional stability given by CHS diagonal struts located along the main elevation at every floor level.

The extension has a skew along its main elevation due to site constraints and consequently it is not a perfectly rectangular building.

The steel design has also incorporated the heavy loadings that the processing equipment will exert into the steel frame.

"Many of the steel sections are larger than they would have been if it was not a factory extension," says Mr Perry. "This over-engineering of the steelwork also has

A steel connection for the structure's roof

the benefit of added fire protection, as larger steel members were a more effective solution in this case."

Border's steel and cladding programme was completed in October and Innovia Films are currently undertaking the machinery fit-out, work that also includes installing additional steelwork within the extension to support equipment.

Summing up Mr Butcher says: "Border is a long-standing partner and has worked at this site on and off for more than 30 years. They even erected the existing production building in two previous phases in the 1980s. They erected and clad the extension on schedule and production is due to begin in March 2015."

The clad structure nears completion

Steel erection began on the smaller Haymarket plot

FACT FILE
St James's Market, London
Main client: Crown Estate and Oxford Properties
Architect: Make
Main contractor: Balfour Beatty
Structural engineer: Waterman
Steelwork contractor: William Hare
Steel tonnage: 3,500t

Market design checks out with steel

Two eight-storey steel framed commercial buildings are spearheading a major investment programme for the St James's area in central London. Martin Cooper reports.

A major ten-year investment programme that will revitalise the renowned St James's area of London with a new public square, offices, retail outlets and high quality residences is under way

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

One of the eight-storey buildings at 14-22 Regent Street will feature a retained façade, allowing the new structure to fit seamlessly into its historic streetscape. Behind the façade a new steel framed structure will be erected accommodating retail at basement and ground floor levels, with offices above.

The 52-56 Haymarket block has a slightly smaller footprint but will be highlighted by an aesthetic curved cladding incorporating glass, Portland Stone and horizontal metal detailing in response to the surroundings. Like its neighbour this steel framed structure will also have retail space at basement and ground floor levels, with offices occupying the upper seven floors.

Working on behalf of Crown Estate and Oxford Properties, main contractor Balfour Beatty started onsite in September 2013. A demolition phase commenced almost immediately, with the entire Haymarket plot cleared and the adjoining Regent Street block demolished with the exception of the 140m-long retained 1920s façade that runs along the most part of three elevations.

Early works have also included excavating and deepening the Regent Street block's basement and making provision for its service ramp. As the Haymarket structure's basement lacks the space for a ramp, a 5.5m-long tunnel beneath St Albans Street will connect both buildings.

"The demolition of Haymarket was fairly straightforward, but during the same phase on the Regent Street block we had to simultaneously install a 200t steel facade retention system which took nearly four months," says John McCallion, Balfour Beatty Project Director.

Regent Street's Grade II listed retained façade is predominantly 350mm deep and made of masonry wrapped around a supporting steel frame. To keep this five-storey high wall stable during the demolition and construction phase, engineers from Wentworth House Partnership designed a support frame consisting of a series of steel belt trusses and braced steel towers. The façade is clamped to the belt trusses with ties through the windows and internal waler beams, all carefully set out to avoid clashes with the new steelwork.

The belt trusses are substantial and serve a double purpose by also supporting some of the site's welfare cabins high above Regent Street's pavement.

Only when the majority of the building's steel frame is up, and the façade has permanent stability from the diaphragm action of the new floors, will the retention system begin to be dismantled.

Steelwork contractor William Hare started the steel erection programme on the larger Regent Street site in late September. It is scheduled to finish both structures (2,500t on Regent Street and 1,000t on Haymarket) by May 2015.

One of the major design issues on both of the structures was the integration of services and how to maximise the floor-to-ceiling heights, while being sympathetic to the existing window levels in the retained façade.

"On both buildings all of the services have been integrated within the floor beams," says Adam Suthers, William Hare Project Engineer. "This was quite a challenge as the floor beams had to span quite long distances for the required column free areas, while at the same time not be too deep so as to interfere with the needed shallow floor construction."

The solution was for William Hare and structural engineer Waterman to design steel frames utilising a mixture of UKB sections and 510mm deep fabricated cellular beams. These sections have 350mm deep holes to accept the services within their depth and were stiff enough to span the required grids, which are up to 18m in places.

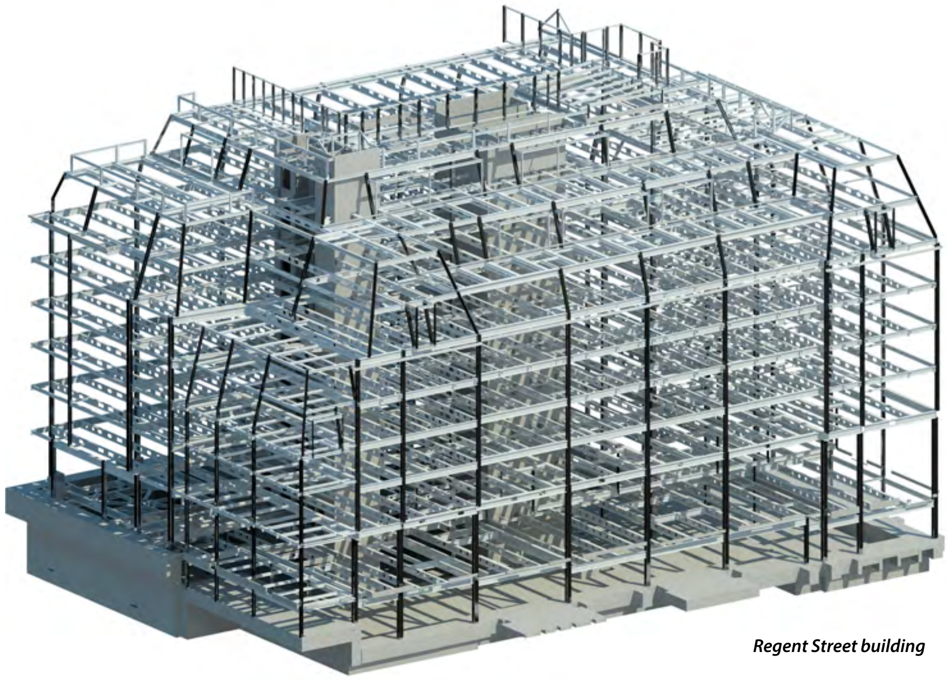
In order to keep the floor zone as shallow as possible a 140mm deep topping will be applied on each floor level with the exception of the first floor where a thicker 250mm slab will be need for acoustics.

"It is important to isolate the retail zones from the commercial spaces within each building," explains David Fung, Waterman Director.

Both buildings have a similar long span design with a maximum of four internal columns with concrete cores supplying the lateral stability to the frames.

The Regent Street block will feature a double height ground floor retail zone,

BIM approach ensures buildability



Regent Street building

Coordination between the entire project team ensured the most efficient and quickest methods of construction were used for this project.

"To make sure all of the services were integrated within the floor beams and there were no clashes anywhere on either frame was an exercise reliant on the early production of a BIM model," says Dylan Wright, Balfour Beatty Structural Manager .

"It was important that all of the project team was involved and this will ensure a quicker construction programme."

Another area where coordination between trades has paid dividends was the design of embedment plates. As the connector for the steel beams to the concrete cores in each of the two buildings, it was crucial that they were designed and positioned correctly for efficiency and safety.

"The long span beams are heavily loaded especially at the corners of the buildings where the spans are longest, so these were key areas for the plates to be designed and installed correctly," adds David Fung, Waterman Director.

Summing up the BIM philosophy, Adam Suthers, William Hare Project Engineer says: "It takes more than just a BIM model, it requires collaborative BIM personnel which is what we have on this project."

The retained façades of the Regent Street plot

containing a mezzanine floor hung from the first floor steelwork.

Centrally positioned within the building will be a large full-height lobby/entrance hall. A highly architectural feature steel scissor staircase will be positioned and supported off a 550mm × 550mm × 25mm Jumbo SHS at each level.

Fabricated from 75mm thick plate the slender staircase will be delivered to the project in 16 single prefabricated flights. These will then be welded onsite, with each flight propped until it is welded to the upper support beam.

The staircase will be clad in Corian, a decorative material usually used for bathroom or kitchen top surfaces. Because pieces can be bonded tightly together, the Corian cladding will give a seamless joint free surface to the staircase. To achieve this finish, limiting deflection and vibration of the steel staircase structure is critical.

Meanwhile, the Haymarket block's main architectural feature is the main elevation's cascading façade (see left). This will be formed by the steel floor plate stepping out at each level, with a series of 1.5m wide cantilevers achieving the desired façade design.

The St James's Market project is scheduled for an early 2016 completion.

The redevelopment of buildings behind retained façades

Dr Richard Henderson (SCI)

The single most significant constraint on the design of a new building behind a retained façade is the determination of the floor-to-floor height by the existing fenestration. The flexibility to adjust the ceiling height and floor "sandwich" is limited and increasing one inevitably means reducing the other. Equally significant for the construction phase is the presence of the original walls, restricting access to the building perimeter and the site.

Limiting the number of crane lifts over the façade is very important. The adoption of steel framing with floors supported by metal decking means that multiple lifts of precast units are avoided. The floor plates are thin and lighter than with concrete. Structural steelwork allows spans of up to 18m which reduces the number of columns and increases the quality of the commercial space above the ground floor retail areas. Post-tensioned floors are impractical because the edges of the slabs are concealed behind the retained façades. The table forms needed to support wet concrete and the difficulty and crane time involved in transferring the forms are avoided.

Optimal floor "sandwich" thicknesses are achieved by adopting fan-coil units close under the metal deck served by chilled water piped through holes in the floor beams. Rectangular openings accommodate ducts supplying fresh-air.

At ground floor, easily lettable retail spaces require flexibility in the structure to create openings for communication with the basement. Steel floors provide a simple means of achieving the holes because the slabs are thin and the steel framing provides obvious

delineation of the possible arrangements. Cutting holes through concrete slabs is much more difficult by comparison.

At the building perimeter, the retained façades are of varying thickness, reducing in steps with height. In order to maximise the lettable area of the space, the columns are stepped out at the floor level above where the wall thickness reduces. This avoids an increasing gap between the back of the façade and the new steel column. The retained façade is tied into the floor diaphragm either by welding to the original columns which remain within the façade or by drilled in fixings to the back of the wall, the inner skin of which is usually either brick or block. Resin anchors are used to avoid bursting forces. Tests are carried out to determine the weldability of the original steelwork and the strength of the masonry.

St Vincent Plaza is conveniently located close to many of the city's main arteries

FACT FILE
St Vincent Plaza, Glasgow
Main client: Abstract
Architect: Keppie Design
Main contractor: Bowmer & Kirkland
Structural engineer: Struer
Steelwork contractor: BHC
Steel tonnage: 1,800t

Flexible offices formed with steel

The latest landmark speculative commercial development in Glasgow has utilised structural steelwork for it ease and speed of construction. Martin Cooper reports.

A new modern and flexible office development for Glasgow

The commercial sector is looking up, not just in London but also throughout the UK and in particular Glasgow.

A number of high profile schemes are currently under way in Scotland's largest city including St Vincent Plaza – a striking and efficient building that will provide 15,700m^2 of Grade A office space spread over 11 floors.

Located in the city's business district, St Vincent Plaza will feature a prestigious double height reception area and all of the 10 upper floors will benefit from large flexible column free spaces, due to the structural steel frame only having four internal columns.

The project's flexibility and future proofing has been further enhanced with the addition of enlarged risers that will allow tenants to add additional cabling and ducting.

Main contractor Bowmer & Kirkland started work onsite during October 2013 on a plot that was formerly a car park for an adjacent bank. The company's work commenced with the construction of a nearby replacement car park for the bank's employees. Once this was complete enabling and piling work could begin on the site.

A series of 25m deep piles support a split-level stepped suspended slab that takes into account the sloping site. Consequently the southern elevation includes a lower ground level, while at the northern side (main entrance level) the lowest level is ground floor.

The building's steel frame springs off of pile caps and is set out on a regular grid of 9m × 11m. Fabricated cellular beams, with service holes, have been used on every floor for easy M&E integration.

According to the construction team all framing options for this project were evaluated during the early stages of the design process.

"This is a speculative office development and getting the completed building onto the market as quickly as possible was very important to the client. So a fast track construction programme was essential and steel was the best option for this," says Richard MacDonald, Keppie Design Architect.

The steel framed building was then designed around a number of site constraints, namely the adjacent M8 motorway and its connecting flyover, and a 22m no build zone separating the site from its next-door neighbour.

The proximity of the M8 meant a number of rock anchors, installed during the motorway's construction, protruded into the St Vincent Plaza site. This meant some of the structure's piles and columns had to be designed and installed so as not to clash with these subterranean obstructions.

As the site is bounded by roads along three sides laydown areas for materials are at a premium in and around the project. Steelwork was generally brought to site and erected immediately, leaving other areas of the site clear for other trades to work in. If the project team had gone down a different framing route, the site may have been much more congested with plant and materials, making the logistics far more testing.

"When the steel erection programme initially started we were still piling one part of the site, so coordination between trades has always been a key challenge on this job," explains Paul Wilson, Bowmer & Kirkland Senior Project Manager.

The structure's steel frame gains all of its stability from diagonal bracing, most of which is located within the building's centrally located core. However, some bracing was needed in other locations to afford additional stiffness and this proved to be a challenge.

Eddie Gray, Struer Director says: "Where to put the extra bracing was difficult, as there are no internal partitions to use and we obviously had to avoid window openings and so any blank panels on the exterior at the lower levels generally conceal diagonal bracing."

More bracing is also located within the building's most visual elements, two cantilevers positioned on the north and south elevations. Both are one bay wide (9m), with the southern element cantilevering by 4.5m and the northern by 6m.

The building will feature a large double height entrance lobby

"As well as breaking up the main façades, the north cantilever projects presence along St Vincent while the south cantilever addresses the views into the city centre from the M8," explains MacDonald.

In order to accommodate a 1.5m step-in at ground and first floor levels a girder and truss arrangement was provided over the second and third floors to support the seven floors above and the 6m cantilever. The structural arrangement incorporated two 21m long plate girders each weighing 14t.

From the fourth level upwards, more traditional rolled sections are used for the cantilever. To minimise deflection of the 6m cantilever structure, diagonal struts were installed to provide stiffness.

Steelwork contractor BHC had to bring in a 100t capacity mobile crane to lift in the cantilevering girders, with the rest of the steel frame being mostly erected via the site's tower crane.

Its contract also included the installation of metal decking and precast stairs, as well as erecting 60t of cold rolled steelwork for the rooftop plant enclosures.

Steelwork erection, which involved more than 3,300 individual pieces, was finished last June, and the overall project is scheduled to be completed by mid-2015.

One of the building's two feature cantilevers

Collaboration reaps better rail services

Adey Steel and Tata Steel's Profiling Centre are playing a pivotal role in one of largest rail improvement schemes to be undertaken in modern times.

Network Rail is electrifying the Great Western route between London Paddington and Cardiff that also includes lines to Oxford, Newbury and between Bristol Temple Meads and Bristol Parkway.

With completion set for 2017, the work to one of the UK's oldest and busiest railways will result in improved and quicker connections for southern England and South Wales. It will also enable a fleet of new energy efficient trains to be commissioned that will result in smoother and more comfortable journeys for passengers.

Adey Steel, a long-term customer of Tata Steel's Construction Structures and Rail divisions, has been awarded a £15M contract to fabricate and supply the overhead gantries for the Great Western Electrification programme (GWEp).

On a wider note Tata Steel's Rail division has a long term relationship with the UK's rail industry and has most recently secured the rail and sleeper supply contracts for Network Rail that run for a duration of up to 10 years.

As a result of Adey Steel winning this contract Tata Steel's Construction Structures, Rail and Distribution UK & Ireland sales teams collaborated and pooled their expertise to obtain a new business opportunity for its Plate Profiling Centre located at Steelpark, near Wolverhampton.

The Profiling Centre processes steel plate manufactured at Tata Steel's Scunthorpe site into a wide variety of different components. The plate profiling, additional processing (such as machining) and supply chain management is a value-added activity, generating real benefits for Tata Steel's customers. Growing high-volume repeat business, such as this rail project, is an ideal fit for the new Centre's capability.

Plasma profiled plate is supplied to Adey Steel from the Profiling Centre in a variety of different sizes for the various components required for Network Rail's project. The largest pieces are 13m long and thicknesses vary from 10mm up 20mm.

Steel gantries

Adey Steel has won a three and a half year contract to supply Network Rail with overhead line electrification steelwork comprising of gantries, masts and brackets for the Great Western electrification programme.

"We are partnering closely with Tata Steel who are key plate suppliers to our manufacturing facility which is responsible for fabricating and galvanizing a variety of components that are assembled onsite to form the various rail gantry structures," explains Adey Steel Managing Director Andrew Adey.

Adey Steel cuts, fabricates, welds and tests the steelwork to produce a number of components that need to be repetitively produced during the programme. In order to produce these items without error, and to the highest quality, the company has a range of specialist jigs set up at its fabrication shop.

The gantries vary in size depending on the number of tracks they are spanning. The largest components Adey Steel is producing are 12m-long beams to be used as gantry centre sections. They measure 1m high x 1m wide and weigh 3.5t each.

Meanwhile, the product Adey Steel is producing the highest quantity of is a 250kg foundation bracket.

Once the components are completed they are moved to Network Rail's project stockyard at Swindon where they are held until needed onsite.

Use of LTBeamN

Calculating N_{cr} and M_{cr} by hand for use in Eurocode design can be challenging for anything but the simple cases. LTBeamN, a free software tool, can readily calculate these values, including complex situations such as tapered beams and unusual restraint arrangements. Constantinos Kyprianou, Engineer at the Steel Construction Institute, offers an overview on the use of LTBeamN and compares its results with some standard cases.

Introduction

LTBeamN was developed by CTICM and is a considerable upgrade to its predecessor LTBeam. The latest version has improved interfaces, improved graphics and the capability to analyse complex scenarios, including tapered members. The 'N' indicates that the scope of the latest version includes the effect of axial compression.

Buckling resistance

Under pure compression, BS EN 1993-1-1 requires the elastic critical force N_{cr} to be calculated. Although this is straightforward for flexural buckling, it is not straightforward for torsional or torsional-flexural buckling, especially if the section is not bi-symmetric, or has intermediate restraints to one flange. In these situations, LTBeamN can provide a convenient solution.

For unrestrained beams, the Eurocode requires that the elastic critical moment M_{cr} is determined. Although closed expressions may be used to calculate M_{cr} for orthodox cases, the calculation becomes effectively impossible without software for more complex scenarios.

Using LTBeamN

The aim of this article is to describe some of the most important features of LTBeamN and to demonstrate the verification of some standard cases.

Users can define almost any common open section, either by choosing it from a pre-defined catalogue, or by defining dimensions for a common forms of cross sections, or by section properties for unorthodox sections. The program restricts sections to mono-symmetric.

Member definition

Users can vary the depth of the section along its length, in order to allow the analysis of haunched and tapered sections, and assemble members from different upper and lower sections. Figure 1, below, shows a member with a haunched section at one end and a tapered section at the other, demonstrating the versatility of the software.

Restraints

LTBeamN allows flexibility when defining restraints, in terms of position in both dimensions. Restraints can be defined at any position in the web, at the flange or above the flange. Users can define the behaviour for each restraint with four different degrees of freedom. To create a lateral restraint, the lateral displacement is set to "fixed". For torsional restraints, the degree of freedom "θ" (which is twisting) is additionally set to "fixed". Some effort needs to be invested in appreciating the opportunities for unorthodox restraint conditions, such as spring supports.

Applied actions

LTBeamN has a number of different ways to define applied actions. Firstly, "External Loading" may be used to define point loads and distributed loads along the length and the depth of the member. Self weight may be included as an option. Alternatively, the "Internal Loading" option may be used to define the bending moment diagram and axial load directly.

Special features

LTBeamN has the facility to calculate solutions for up to 10 buckling modes, as illustrated in Figure 2, which is educational, even if not directly used in design, since in design the first buckling mode with the lowest value of N_{cr} and M_{cr} is of most interest.

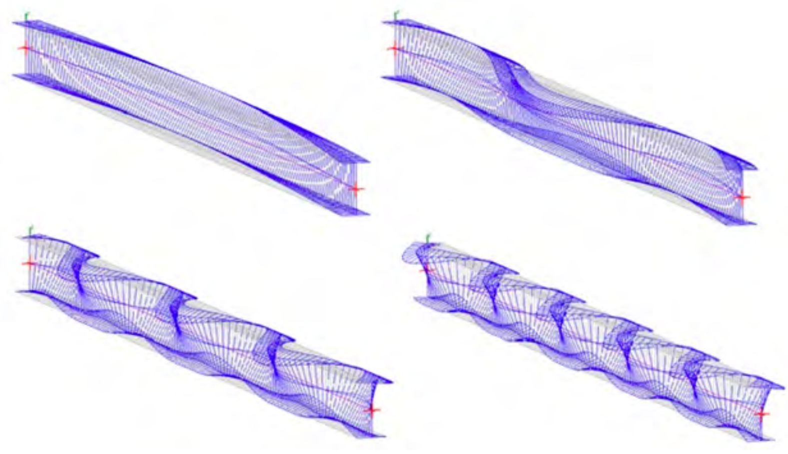


Figure 2: Various buckling modes

Analysis results

LTBeamN provides numerical results and a graphical output. The

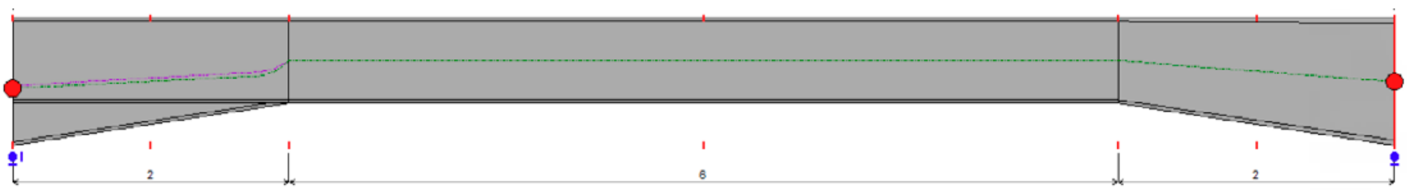


Figure 1: Member with a haunched and tapered section

visual representation of the buckled form can be particularly useful when checking that the buckled form recognises the restraint conditions anticipated by the user. As with all software, it is beneficial to have an expectation of the results and buckled form before using the program.

The results may be filtered by 'blocking' to provide the values for M_{cr} or N_{cr} in isolation. For M_{cr} alone, the option "N Blocked" is selected, and vice versa if N_{cr} is required. The combined effect of M_{cr} and N_{cr} can be calculated if required.

Verification

In this article, the use of LTbeamN is compared to a series of standard situations, using a 610 × 305 × 179 universal beam.

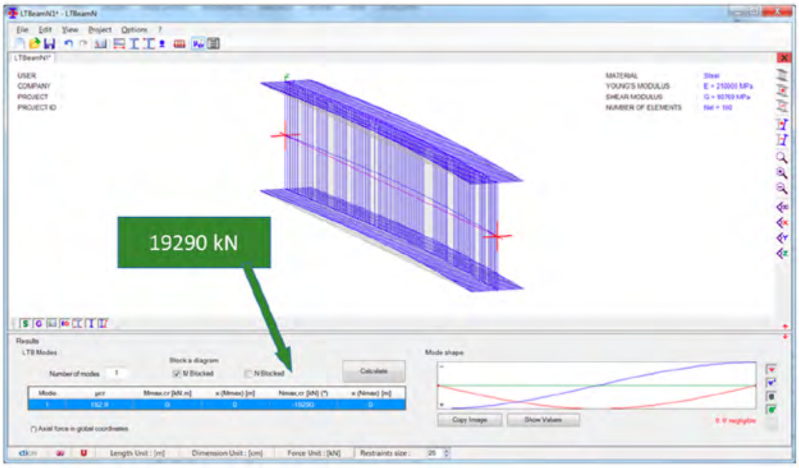


Figure 3: $N_{cr,E}$ from LTBeamN

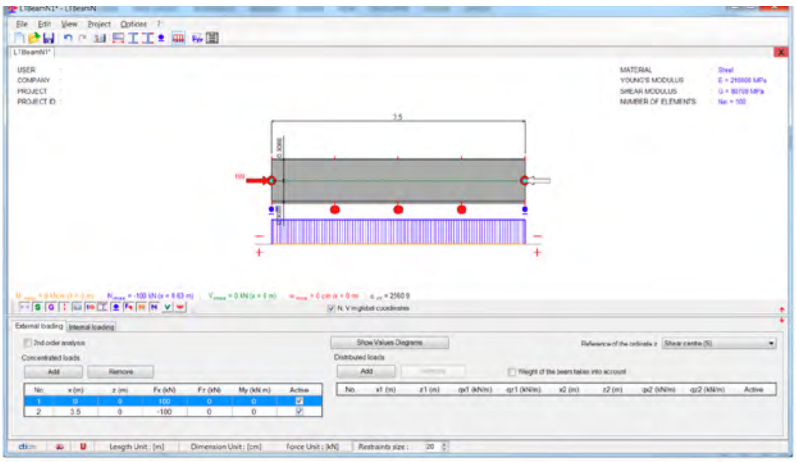


Figure 4: $N_{cr,T}$ from LTBeamN - intermediate restraints to one flange

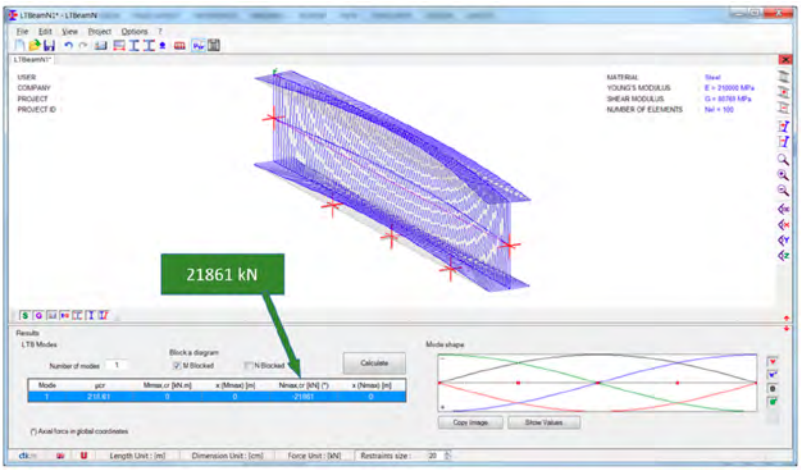


Figure 5: $N_{cr,T}$ from LTBeamN – buckled form

Elastic critical force for flexural buckling

The elastic critical flexural buckling force can be calculated using Euler's equation:

$$N_{cr,E} = \frac{\pi^2 EI_z}{L^2} = \frac{\pi^2 \times 210000 \times 11400 \times 10^4}{3500^2} \times 10^{-3} = 19288 \text{ kN}$$

Using LTBeamN, a compressive forces is applied at either end of the section. Torsional restraints are modelled at each end of the section, at the shear centre. As shown by Figure 3, N_{cr} from LTBeamN was calculated as -19290 kN. The difference is not significant and is due to the slight difference between the section properties given in the software library and in the "Blue Book". The negative sign simply reflects the convention used in modelling.

Elastic critical force for torsional buckling

The equation presented in BS EN 1993-1-1 Annex BB.3.3.1 evaluates the elastic critical torsional buckling force of an I-section between torsional restraints with intermediate lateral restraints to the tension flange:

$$N_{cr,T} = \frac{1}{i_s^2}\left(\frac{\pi^2 E I_z a^2}{L_t^2} + \frac{\pi^2 E I_w}{L_t^2} + GI_t\right)$$

where:

$$i_s^2 = i_y^2 + i_z^2 + a^2$$

a is the distance between the centroid of the member and the centroid of a restraining member, such as purlins. In this example, the restraining member is taken as 180 mm deep.

Therefore:

$$a = 180/2 + h/2 = 90 + 620.2/2 = 400.1 \text{ mm}$$

$$i_s^2 = 259^2 + 70.7^2 + 400.1^2 = 232159.5 \text{ mm}^2$$

$$N_{cr,T} = \frac{1}{232159.5}\left(3.09{\times}10^{12} + 1.726{\times}10^{12} + 2.746{\times}10^{11}\right) \times 10^{-3} = 21927 \text{ kN}$$

In LTBeamN, three intermediate lateral restraints at equal distances along the length acting 400.1mm vertically from the shear centre were introduced, as shown in Figure 4. The calculated elastic critical force is 21861 kN. The buckled form is shown in Figure 5.

If a continuous restraint is modelled at 400.1 mm below the shear centre (as an alternative to three discreet restraints), N_{cr} = 21861 kN, as previous. This demonstrates that in this case, the effect of the intermediate restraints is equivalent to a continuous restraint.

Elastic critical moment, M_{cr}

For an unrestrained beam with a uniform bending moment diagram, C_1 = 1 and M_{cr} is given by:

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

$$= 1 \times 19.3 \times 10^6 \times \sqrt{89.4{\times}103 + 14.2{\times}10^3} \times 10^{-6}$$

$$= 6212 \text{ kNm}$$

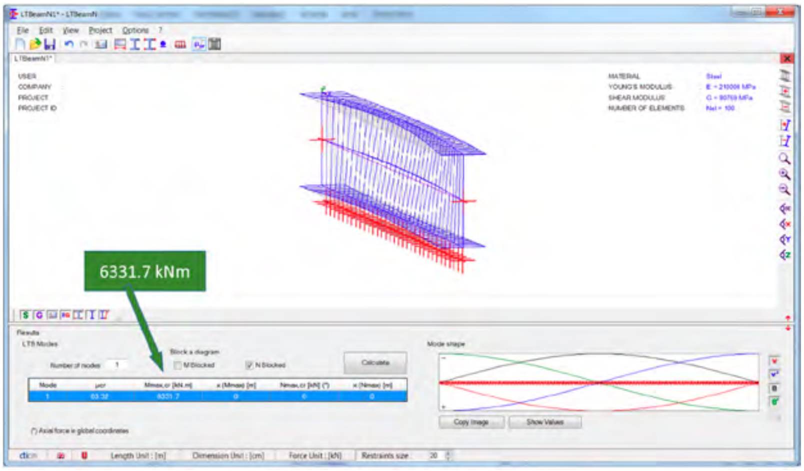


Figure 6: Continuous restraint outside the tension flange

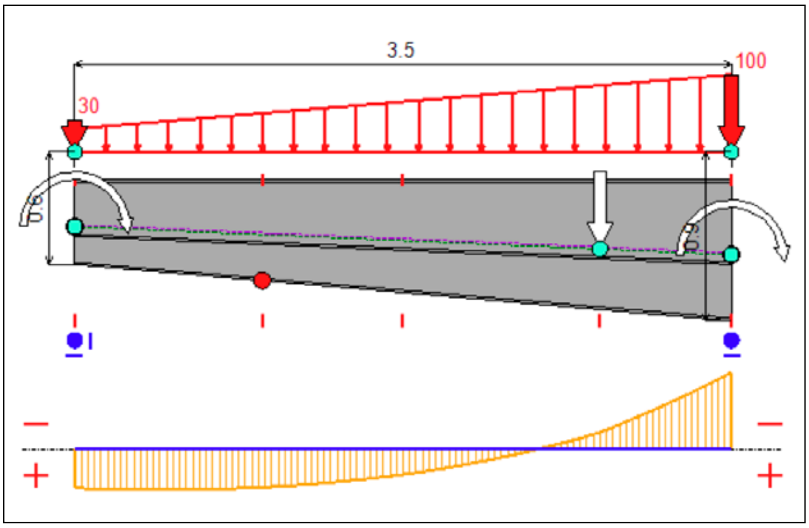


Figure 7: Unorthodox member, restraints and loading

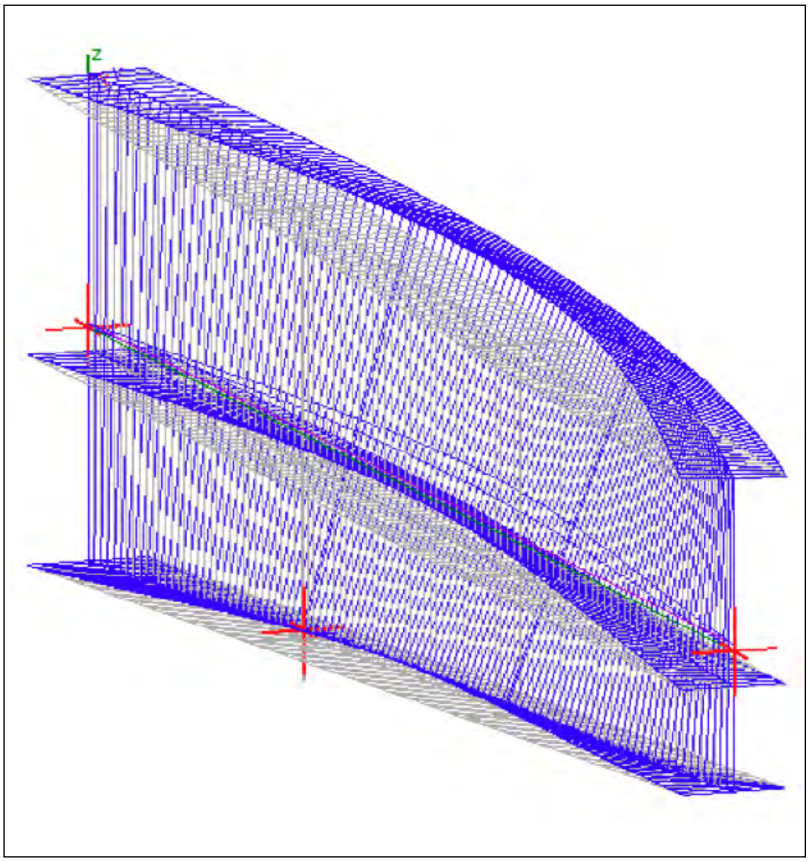


Figure 8: Buckled form of an unorthodox member

With a uniform moment, modelled with an equal moment at each end of the member, LTBeamN calculates M_{cr} as 6176 kNm. The difference in values is insignificant.

Tension flange restraint

For simple cases of tension flange restraint, closed expressions are available. Assuming continuous lateral restraint along the tension flange, $M_{cr,T}$ for a uniform bending moment diagram is given by:

$$M_{cr,T} = \frac{i_s^2}{2\alpha} N_{cr,T} = \frac{232159.5}{2 \times 400.1} \times 21927 \times 10^{-3} = 6362 \text{ kNm}$$

A continuous restraint may be modelled in LTBeamN. In this case the restraint is at 400.1 mm from the shear centre. The results from LTBeamN are shown in Figure 6.

The calculated value of M_{cr} is 6331.7 kNm; the difference is small enough to be ignored and probably follows from the use of rounded values in the closed expression and the slightly different section properties used in the software library.

Complex situations

Although the verifications presented here are all for common cases, where closed solutions are available, software is almost essential in unorthodox cases. Figure 7 shows:

- A haunched section, tapering in elevation and width
- An intermediate restraint to one flange only
- Point loads, varying distributed loads and bending moments applied (the distributed load is applied as a destabilising load, above the flange)

In this (admittedly obscure) situation, software is the only feasible approach. M_{cr} can be calculated and the buckled form examined (Figure 8).

Conclusion

LTBeamN facilitates the efficient calculation of N_{cr} and M_{cr}, being particularly useful in complex situations not covered by standard expressions. Some effort must be expended in becoming familiar with the tool and understanding all the options available. Before using the software, some expectation of the result is important, not to verify the inner workings of the software, but to ensure the data has been input correctly.

AD 385
Questions and Answers on SCI P391

This Advisory Desk Note covers some Q & A on SCI publication P391 (Structural Robustness of Steel Framed Buildings, in accordance with Eurocodes and UK National Annexes, 2011).

Q1 Page 25, Section 3.3.3 Annex A.
If the specified cause of accidental action is less onerous than the requirements of BS EN 1991-1-7, for example a specified blast loading of 10 kN/m² (< 34 kN/m²), should the design be based on the specified blast loading, or on the more onerous requirements of BS EN 1991-1-7?
A1. If there is a blast loading specified by the client, then the specified loading should be used. But, if there is also a requirement to satisfy Building Regulations and the key element approach is used, then the 34 kN/m² should be used.

Q2 Page 38, Section 5.2.2 Design rules and page 103, Example 1 – Class 1 building.
According to 5.2.2, for Class 1 buildings, roof beam-to-column connections need not be designed for a tie force of 75 kN if the steelwork only supports roof cladding that weighs not more than 0.7 kN/m² and carries only imposed loads and wind loads. However, Example 1 requires that roof beams subject to such loading should be capable of resisting the minimum level of horizontal tying i.e. 75 kN. Which is correct?
A2. The guidance given in Section 5.2.2 is correct. Example 1 is conservative in its approach.

Q3 Page 45, section 6.3.1 Chasing loads, paragraph 2.
This refers to a beam connected to a column web with an end plate connection. Presumably, the column web also needs to be checked if the connection is formed using a fin plate or web cleats?
A3. Yes, the guidance is also applicable to other connection types.

Q4 Page 49, Section 6.3.8 Beam arrangements.
In Table 6.1, for g_k = 4.0 kN/m² and q_k = 4.0 kN/m², T_3 is given as 270 kN. Should this be 135 kN? The calculation is based on the equation given in Figure 6.10, i.e
$T_3 = 0.4x(g_k + \Psi q_k)LB$ = 0.4 x [4.0 + (0.5 x 4.0)] x 7.5 x 7.5 = 135 kN.
A4. Yes, in this case the value for T_3 should be 135 kN.

Q5 Page 60, Section 7.6.2 (f) Design strategy.
If the notional removal of any bracing element would result in the building being unstable, should that bracing element be designed as a key element regardless of the tying strategy?
A5. The member should only be considered as a key element if the tying requirements, or notional removal requirements, have not been satisfied.

Q6 Page 62/63, section 7.6.5 Combination of actions for notional removal.
It is stated that $\Psi_{1,1}$ is the factor for the frequent value of the variable action $Q_{k,i.}$ Should this be $Q_{k,1}$?
A6. Yes, the factor should be $Q_{k,1}$

Q7 Page 121, Example 6 - Class 2b building – Transfer beam.
Horizontal ties. For an internal transfer beam, $T_i = 0.8(g_k + \Psi q_k)sL + 0.5V_c$ in which s and L are the spacing and the length of the transfer beam, respectively. In Example 6, s = 7.5m, and L = 12.5m. However, the tie force T_i is given as :
T_i = 0.8(3.5 + 0.7 x 6.0) x 6.0 x 7.5 + 0.5 x 512 = 533 kN. Is this correct?
A7. T_i should be calculated as: T_i = 0.8(3.5 + 0.7 x 6.0) x 7.5 x 12.0 + 0.5 x 512 = 810 kN

Q8 Page 126, Example 6 - Class 2b building – Transfer beam.
Under the heading "Resistance of beam slab connection", the upward push-out value of the shear stud is assumed to be 10 kN. Are these push-out values documented anywhere?
A8. Unfortunately, there is no such reference document for these values. An estimated value was used in the example.

Q9 Page 126, Example 6 - Class 2b building – Transfer beam.
Under the heading "Load on beam slab connection", the load on the beam-to-slab connection due to the accidental action is given by: F_1 = 34 x 7.5 = 255 kN per m length. Why isn't F_1 given by:
F_1 = [(2.25 x storey height)² x 34]/9.0 = 306 kN/m
i.e. using the same approach which was used earlier in Example 6?
A9. An alternative option would be to use the approach suggested in the question, but see answer to question 10 below.

Q10 Page 126, Example 6 - Class 2b building – Transfer beam.
In the case of "upwards accidental action", the slab becomes detached from the transfer beam; therefore the accidental load from the slab can be ignored. However, the beam still supports the column at mid-span. If we assume that under such accidental loading, the unrestrained secondary beams provide no lateral restraint to the transfer beam, we then have an unrestrained transfer beam subject to a destabilizing load. In which case, shouldn't the transfer beam be designed to resist a net sagging moment $M_{y,Ed}$ given by $M_{y,Ed}$ = 1539 – 190 = 1349 kNm ? (Ignoring accidental loading applied upwards to the underside of secondary beams)
A10. Yes, it could be done that way. However, in the case of robustness and avoidance of disproportionate collapse the design codes cannot give rules for all situations so the engineer is required to develop a sensible, logical approach based on engineering principles. This does mean that there may be more than one way to approach particular situations.

Contact: **Andrew Way**
Tel: **01344 636525**
Email: **advisory@steel-sci.com**

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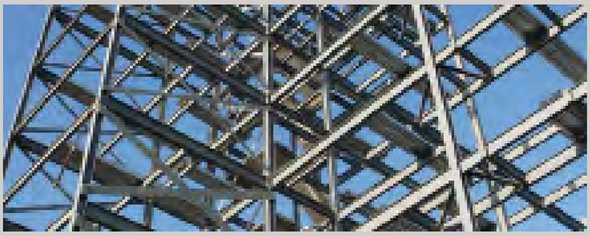

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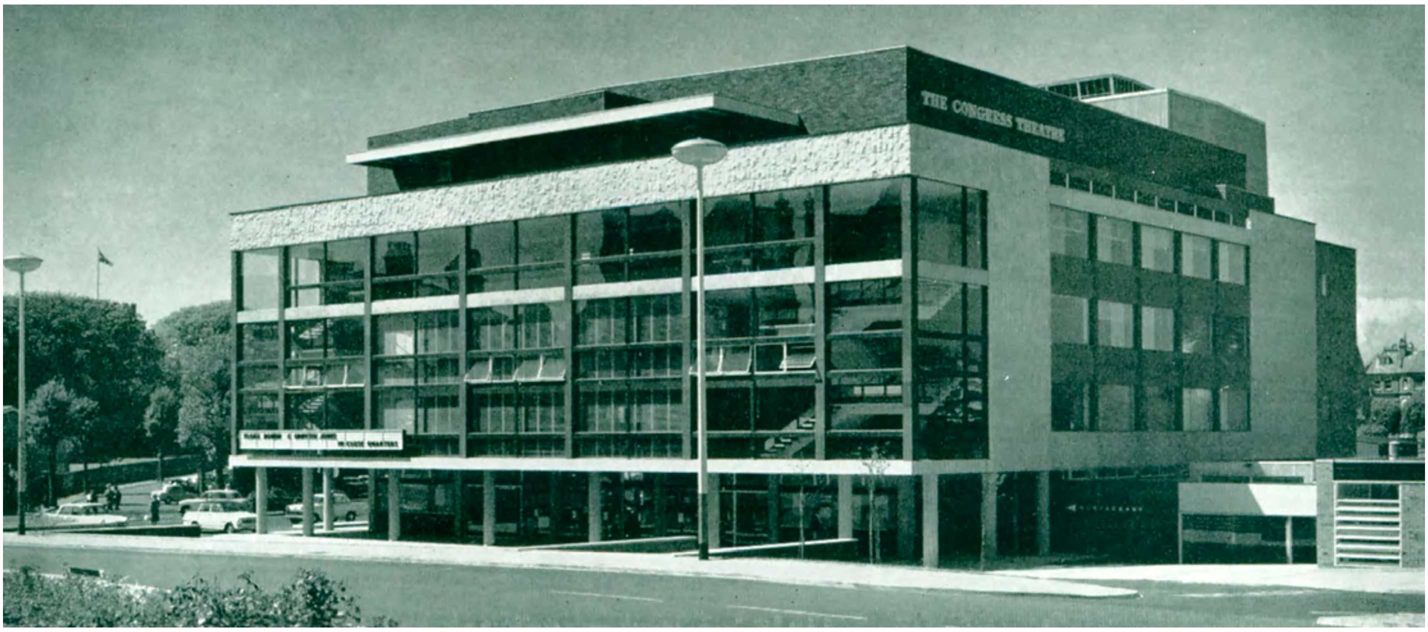


The Congress Theatre Eastbourne

FROM BUILDING WITH STEEL NOV 1964

The steelwork for the Congress Theatre is interesting on account of the intricate and unusual detailing which is not normally encountered in structural steelwork. The three principal sections of the theatre in which steel is used are the auditorium roof, the backstage area and the restaurant. The restaurant in particular necessitated workmanship of the highest quality which was maintained throughout by the steelwork contractor.

Whilst reinforced concrete was used for the general structure of the theatre on account of the varied spans and heavy loadings which had to be accommodated in the flat slab design envisaged by the architect, structural steelwork was selected for the roofs and restaurant as it was considered more economical for both the long spans with light loading and the less stringent fire precautions required.

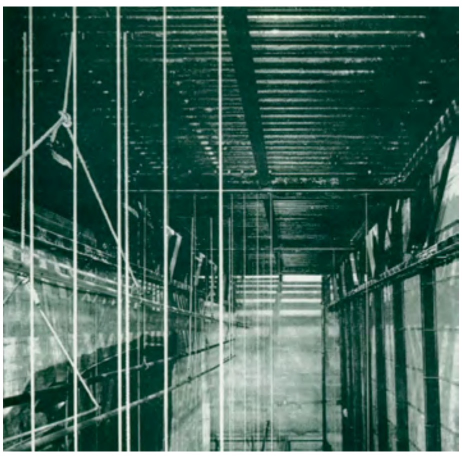
Four trusses span the longitudinal direction over the auditorium, this span of 95 ft was chosen in lieu of 72 ft transversely so the weight of the roof would counter the overturning of the balcony. Spanning the trusses in this direction also assisted the provision of simple trunking for the ventilation system, particularly by incorporating all the transverse bracing in a vertical plane between the inner trusses only, thus giving the maximum amount of clear space in each outer section. The main top and bottom members of the trusses consist of two No. 8-in by 4-in angles, 4 inches apart, so that the verticals, 4-in by 3-in joist sections could be welded between them. The diagonals varied from 5-in by 3-in angles to 3-in by 3-in angles depending on the loadings.

6-in by 3-in purlins at 6 ft centres span 18 ft between the trusses, the slope in the roof being made by supporting the purlins at their top and bottom flanges respectively. The tank and machinery room extending for the whole width of the auditorium is suspended directly from the trusses by four steel hangers. The false ceiling which in a theatre tends to be rather heavy is suspended off 5-in by 3-in angles spanning between the bottom members of the trusses. At the proscenium end of the auditorium, in addition to the false ceiling, a sound baffle, loudspeaker system and maintenance walkways are suspended requiring larger supporting angles.

Initially the trusses both backstage and over the auditorium were specified to be all welded. Due to the restrictions as to access, particularly around the auditorium, the steelwork contractor was granted permission to fabricate the trusses in sections which would facilitate the use of the main contractor's tower crane situated in the centre of the auditorium. A rise, to offset an anticipated deflection of one inch, was introduced by prebending the top and bottom members of each truss section and by raising the scaffolding. All site connections were made by using load indicating high strength friction grip bolts as this provided an easy way of checking the correct bolt tensions.

Backstage, three trusses span 65 ft transversely between the two flank walls of the stage tower and are supported on specially designed steel shoes bolted to the concrete walls. The trusses are at 13-ft centres and are 7 ft 9 in deep overall. The top and bottom members consist of two No. 5-in by 3-in angles with the verticals 4-in by 3-in joist sections again welded between them, all the diagonals being 3-in by 3-in angles. The rear wall of the stage tower is formed by 7-in by 4-in joists at 6-ft centres carrying woodwool slabs fixed with U bolts.

Below: Backstage trusses showing bolted connections, stage grid supporting scenery and backcloth, vertical joists forming rear wall.



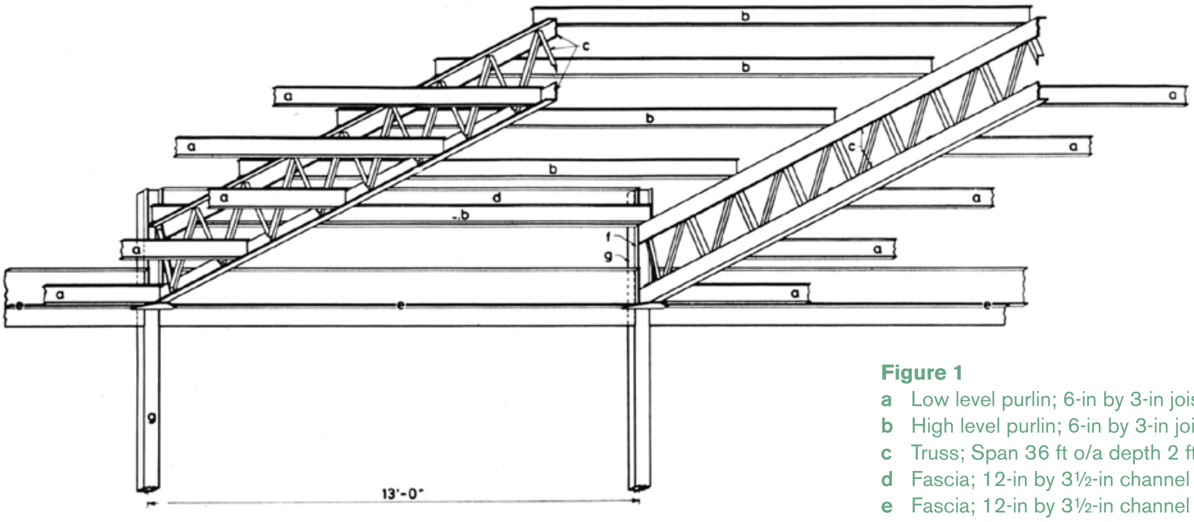


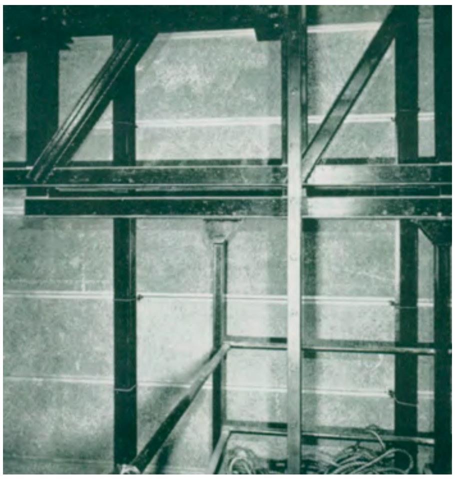
Figure 1
- **a** Low level purlin; 6-in by 3-in joist
- **b** High level purlin; 6-in by 3-in joist
- **c** Truss; Span 36 ft o/a depth 2 ft 3 in
- **d** Fascia; 12-in by 3½-in channel
- **e** Fascia; 12-in by 3½-in channel + 6-in by 3-in channel
- **f** Support for truss and fascias; 5-in by 2½-in channel
- **g** Coumn; 5-in by 5-in rectangular hollow section

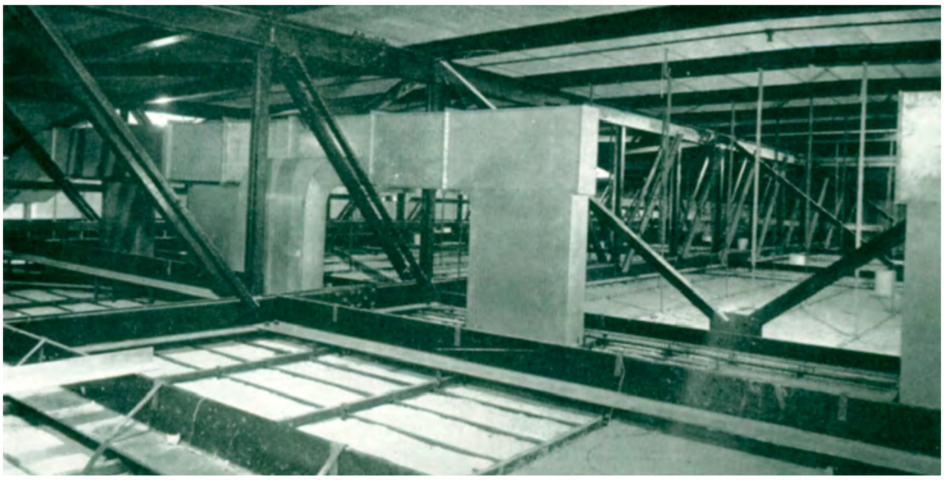
These upright joists span 26 ft from the main roof level to the top chord of the rear truss, the connection at the upper level being a sliding joint to enable the truss to deflect independently. The roof purlins are 5-in by 3-in joist at 6-ft centres and the haystack lantern consists of frames at the same centres made out of 5-in by 3-in joist sections.

In addition to supporting the fly gallery the trusses support the 'stage grid'. This is an intricate mat of steelwork, the function of which is to assist the moving and supporting of the stage sets, etc. Consequently it is designed for horizontal thrusts as well as for vertical loadings. The main members of the grid are 10-in by 3-in channels, the secondaries being 7-in by 3-in channels above which are laid 3-in by 1½-in channels at 6-in centres.

The link restaurant between the existing Winter Gardens and the Congress Theatre required maximum amount of circulation space between supports. There was also an architectural requirement to expose as much of the structure as possible on the elevations. A steelwork design was evolved using shallow trusses, rectangular hollow sections as columns and channels together with angles as fascia elements. Each truss spans 36 ft and is 2 ft 3 in deep overall. Interest is added to the roof by alternate bays being at high and low levels respectively. The 6-in by 3-in purlins span 13 ft being supported on the top and bottom members of the trusses.

The problem of an 18-in deep smooth face fascia in steel was overcome by bolting together a 12-in by 3½-in channel and a 6-in by 3-in angle. Prior to bolting, an epoxy resin was applied to the joint faces and after setting, the excesses were ground off, thus providing not only a smooth face but a waterproof joint. The trusses were supported by 5-in by 2½-in channels welded onto the backs of the external 5-in by 5-in columns. These channels also served to support the fascias which were bolted to the sides of the channels. *Figure 1* clearly shows the intricate detailing which was required.





Above left: Detail backstage showing rear truss, fly gallery, stage grid and vertical joists.

Above: Auditorium roof showing truss, bolted connections, transverse bracing, purlins and angles supporting false ceiling.

Left: Restaurant with rectangular hollow sections as columns, channels and angles as fascias.

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

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- **H** Large span trusswork (over 20m)
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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 C Bacon Engineering Ltd	01953 850611			●	●		●										2		Up to £2,000,000
A & J Stead Ltd	01653 693742			●	●					●	●			●	●		2		Up to £100,000
Access Design & Engineering	01642 245151				●	●			●	●	●			●	●	✔	2		Up to £4,000,000
Adey Steel Ltd	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			●	●	●	●			●	●			●	●	✔	2		Up to £800,000
ASD Westok Ltd	0113 205 5270												●			✔	4		Up to £6,000,000
ASME Engineering Ltd	020 8966 7150				●	●				●	●			●	●	✔	3	Silver	Up to £1,400,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●	●	●				●			●	●	✔	2		Up to £1,400,000
Austin-Divall Fabrications Ltd	01903 721950			●	●		●	●		●	●			●	●	✔	2		Up to £800,000
B D Structures Ltd	01942 817770			●	●	●	●				●	●		●		✔	2		Up to £800,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●				✔	4		Up to £1,400,000
Barnshaw Section Benders Ltd	01902 880848												●			✔	4		Up to £1,400,000
BHC Ltd	01555 840006	●	●	●	●	●	●	●			●	●		●	●	✔	4		Above £6,000,000
Billington Structures Ltd	01226 340666		●	●	●	●	●	●	●	●	●	●		●		✔	4	Gold	Above £6,000,000
Border Steelwork Structures Ltd	01228 548744			●	●	●	●			●	●				●		2		Up to £3,000,000
Bourne Construction Engineering Ltd	01202 746666		●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	Gold	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●		●	●	●	●	●	●	●	●			●	●	✔	4		Up to £3,000,000
Builders Beams Ltd	01227 863770				●					●				●	●	✔	2		Up to £1,400,000
Cairnhill Structures Ltd	01236 449393	●			●	●	●	●	●	●				●	●	✔	4	Gold	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				●		●	●		●	●				●	✔	2		Up to £6,000,000
Cook Fabrications Ltd	01303 893011				●					●	●			●	●		2		Up to £800,000
Coventry Construction Ltd	024 7646 4484			●	●	●	●		●	●	●			●	●	✔	2		Up to £800,000
D H Structures Ltd	01785 246269			●	●		●				●						2		Up to £100,000
Duggan Steel Ltd	00 353 29 70072		●	●	●	●	●	●			●					✔	4		Up to £4,000,000
ECS Engineering Services Ltd	01773 860001	●		●	●	●	●	●	●	●	●			●	●	✔	3		Up to £2,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●		✔	4	Gold	Up to £6,000,000
EvadX Ltd	01745 336413			●	●	●	●	●	●	●	●	●				✔	2	Gold	Up to £3,000,000
Four Bay Structures Ltd	01603 758141			●	●					●	●			●	●		2		Up to £1,400,000
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●			●				●		2		Up to £2,000,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●		✔	2		Up to £800,000
Gregg & Patterson (Engineers) Ltd	028 9061 8131			●	●	●	●	●				●		●		✔	3		Up to £2,000,000
H Young Structures Ltd	01953 601881			●	●	●	●	●			●			●	●	✔	2		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
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
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)
Intersteels Ltd	01322 337766				●	●	●	●					●			✔	3		Up to £2,000,000
J & A Plant Ltd	01942 713511				●	●									●		2		Up to £200,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●					●		●			4		Up to £6,000,000*
John Reid & Sons (Strucsteel) Ltd	01202 483333		●	●	●	●	●	●	●	●	●	●		●	●	✔	4		Up to £6,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445			●	●	●	●	●	●	●	●	●		●	●	✔	4	●	Up to £3,000,000
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●					✔	2	○	Up to £4,000,000
Legge Steel (Fabrications) Ltd	01592 205320			●	●		●		●	●	●			●	●		2		Up to £400,000
Luxtrade Ltd	01902 353182									●	●				●	✔	2		Up to £800,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●				●	✔	4		Up to £2,000,000
M J Patch Structures Ltd	01275 333431				●					●	●			●		✔	2		Up to £800,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●		2		Up to £1,400,000
Mabey Bridge Ltd	01291 623801	●	●	●	●	●	●	●	●	●	●	●	●	●		✔	4	●	Above £6,000,000
Mackay Steelwork & Cladding Ltd	01862 843910			●	●		●			●	●			●	●	✔	4		Up to £800,000
Maldon Marine Ltd	01621 859000				●	●		●	●	●					●	✔	3		Up to £1,400,000
Mifflin Construction Ltd	01568 613311		●	●	●	●	●				●						2		Up to £3,000,000
Murphy International Ltd	00 353 45 431384	●			●		●				●				●	✔	4		Up to £1,400,000
Newbridge Engineering Ltd	01429 866722	●		●	●	●	●				●				●	✔	3		Up to £1,400,000
Nusteel Structures Ltd	01303 268112						●	●	●	●						✔	4		Up to £4,000,000
Overdale Construction Services Ltd	01656 729229			●	●		●	●			●				●		2		Up to £400,000
Painter Brothers Ltd	01432 374400								●		●				●	✔	2	●	Up to £6,000,000
Pencro Structural Engineering Ltd	028 9335 2886			●	●	●	●	●	●		●			●	●	✔	2		Up to £2,000,000
Peter Marshall (Steel Stairs) Ltd	0113 307 6730									●					●	✔	2		Up to £800,000*
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●	✔	2		Up to £1,400,000
R S Engineering SW Ltd	01752 844511				●					●	●			●	●	✔	2		Up to £100,000
Rippin Ltd	01383 518610			●	●	●	●	●						●	●		2		Up to £1,400,000
S H Structures Ltd	01977 681931						●	●	●	●		●				✔	4	○	Up to £3,000,000
SDM Fabrication Ltd	01354 660895	●	●	●	●	●	●				●			●	●	✔	4		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
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●				●			●	●	✔	2		Up to £200,000
Traditional Structures Ltd	01922 414172			●	●	●	●	●	●		●	●		●	●	✔	2	○	Up to £2,000,000
TSI Structures Ltd	01603 720031			●	●	●	●										2		Up to £1,400,000
Tubecon	01226 345261						●	●	●	●				●	●	✔	4	●	Above £6,000,000*
W & H Steel & Roofing Systems Ltd	00 353 56 444 1855			●	●	●	●	●						●	●		4		Up to £2,000,000
W I G Engineering Ltd	01869 320515				●					●					●	✔	2		Up to £200,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✔	4		Up to £6,000,000
Westbury Park Engineering Ltd	01373 825500	●			●		●	●	●	●	●				●	✔	4		Up to £800,000
William Haley Engineering Ltd	01278 760591			●	●	●			●	●	●					✔	4	○	Up to £2,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●		●		✔	4	●	Above £6,000,000
Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	SCM	Guide Contract Value (1)

Corporate Members

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

Company name	Tel
Balfour Beatty Utility Solutions Ltd	01332 661491
Bluefin Group	020 3040 6723
Griffiths & Armour	0151 236 5656
Highways Agency	08457 504030
Kier Construction Ltd	01767 640111

Company name	Tel
PTS (TQM) Ltd	01785 250706
Roger Pope Associates	01752 263636
Sandberg LLP	020 7565 7000
SUM Ltd	0113 242 7390
Welding Quality Management Services Ltd	00 353 87 295 5335

Associate Members

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

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

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

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

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM
AceCad Software Ltd	01332 545800		●								N/A	
Albion Sections Ltd	0121 553 1877	●									M	
Andrews Fasteners Ltd	0113 246 9992									●	M	
Arcelor Mittal Distribution - Scunthorpe	01724 810810								●		D/I	
ASD metal services	0113 254 0711								●		D/I	
Ayrshire Metal Products (Daventry) Ltd	01327 300990	●									M	
BAPP Group Ltd	01226 383824									●	M	
Barrett Steel Services Limited	01274 682281								●		D/I	
Behringer Ltd	01296 668259					●						
BW Industries Ltd	01262 400088	●									M	
Cellbeam Ltd	01937 840600	●									M	
Cellshield Ltd	01937 840600							●			N/A	
Cleveland Steel & Tubes Ltd	01845 577789								●		M	
CMC (UK) Ltd	029 2089 5260								●		D/I	
Composite Profiles UK Ltd	01202 659237	●									D/I	
Cooper & Turner Ltd	0114 256 0057									●	M	
Cutmaster Machines (UK) Ltd	01226 707865					●					N/A	
Daver Steels Ltd	0114 261 1999	●									M	

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]
Briton Fabricators Ltd	0115 963 2901	●	●	●	●	●	●	●	●	✓	4		✓		Up to £3,000,000
Cairnhill Structures Ltd	01236 449393	●	●	●	●			●	●	✓	4			Gold	Up to £3,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	✓	4	✓	✓	Gold	Above £6,000,000*
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
Mabey Bridge Ltd	01291 623801	●	●	●	●	●	●	●	●	✓	4	✓	✓	Gold	Above £6,000,000
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
Painter Brothers Ltd	01432 374400	●		●					●	✓	2			Gold	Up to £6,000,000
S H Structures Ltd	01977 681931	●		●	●	●	●		●	✓	4		✓	Silver	Up to £3,000,000
Severfield (UK) Ltd	01204 699999	●	●	●	●	●	●	●	●	✓	4		✓	Gold	Above £6,000,000
Non-BCSA member															
Allerton Steel Ltd	01609 774471	●	●	●	●				●	✓	4		✓		Up to £2,000,000
Centregreat Engineering Ltd	029 2046 5683	●	●	●	●		●	●	●	✓	4				Up to £400,000
Cimolai SpA	01223 350876	●	●	●	●	●	●	●	●	✓	4				Above £6,000,000
Concrete & Timber Services Ltd	01484 606416	●	●	●	●	●	●		●	✓	4			Member	Up to £800,000
Donyal Engineering Ltd	01207 270909	●						●	●	✓	3		✓	Member	Up to £1,400,000
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
IHC Engineering (UK) Ltd	01773 861734	●							●	✓	3		✓		Up to £400,000
Interserve Construction Ltd	0121 344 4888							●	●	✓	3				Above £6,000,000*
Interserve Construction Ltd	020 8311 5500	●	●	●	●		●	●	●	✓	3				Above £6,000,000*
Lanarkshire Welding Company Ltd	01698 264271	●	●	●	●	●	●	●	●	✓	4	✓		Member	Up to £2,000,000
P C Richardson & Co (Middlesbrough) Ltd	01642 714791	●						●	●	✓	N/A				Up to £3,000,000

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	
FabTrol Systems UK Ltd	01274 590865		●								N/A	
Ficep (UK) Ltd	01942 223530					●					N/A	
FLI Structures	01452 722200	●									M	●
Forward Protective Coatings Ltd	01623 748323						●				N/A	
Goodwin Steel Castings Ltd	01782 220000	●									N/A	
Graitec UK Ltd	0844 543 8888		●								N/A	
Hadley Group Ltd	0121 555 1342	●									M	○
Hempel UK Ltd	01633 874024						●				N/A	
Highland Metals Ltd	01343 548855						●				N/A	
Hilti (GB) Ltd	0800 886100									●	M	
Hi-Span Ltd	01953 603081	●									M	
International Paint Ltd	0191 469 6111						●				N/A	●
Jack Tighe Ltd	01302 880360						●				N/A	
Jamestown Cladding & Profiling Ltd	00 353 45 434288	●									M	
John Parker & Sons Ltd	01227 783200								●	●	D/I	
Joseph Ash Galvanizing	01246 854650						●				N/A	
Jotun Paints (Europe) Ltd	01724 400000						●				N/A	
Kaltenbach Ltd	01234 213201					●					N/A	
Kingspan Structural Products	01944 712000	●									M	●
Lindapter International	01274 521444									●	M	

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM
Murray Plate Group Ltd	0161 866 0266								●		D/I	
National Tube Stockholders Ltd	01845 577440								●		D/I	
Peddinghaus Corporation UK Ltd	01952 200377					●					N/A	
PPG Performance Coatings UK Ltd	01773 814520						●				N/A	
Prodeck-Fixing Ltd	01278 780586	●									D/I	
Rainham Steel Co Ltd	01708 522311								●		D/I	
Sherwin-Williams Protective & Marine Coatings	01204 521771						●				M	○
Sika Ltd	01707 384444						●				M	
Simpson Strong-Tie	01827 255600									●	M	
Structural Metal Decks Ltd	01202 718898	●									M	●
Tata Steel	01724 404040				●						M	
Tata Steel Distribution UK & Ireland	01902 484000								●		D/I	
Tata Steel Ireland Service Centre	028 9266 0747								●		D/I	
Tata Steel Service Centre Dublin	00 353 1 405 0300								●		D/I	
Tata Steel Tubes	01536 402121				●						M	
Tata Steel UK Panels & Profiles	0845 3088330	●									M	
Tekla (UK) Ltd	0113 307 1200		●								N/A	
Tension Control Bolts Ltd	01948 667700						●			●	M	
voestalpine Metsec plc	0121 601 6000	●									M	●
Wedge Group Galvanizing Ltd	01909 486384						●				N/A	
Yamazaki Mazak UK Ltd	01905 755755					●					N/A	

New and revised codes & standards

From BSI Update November 2014

BS EN PUBLICATIONS

BS EN 13001-2:2014
Crane safety. General design. Load actions
Supersedes BS 2573-1:1983 and BS 2573-2:1980 which remain current

NEW WORK STARTED

ISO 10211
Thermal bridges in building construction. Heat flows and surface temperatures. Detailed calculations
Will supersede BS EN ISO 10211:2007

ISO 13370
Thermal performance of buildings. Heat transfer via the ground. Calculation methods
Will supersede BS EN ISO 13370:2007

ISO 13786
Thermal performance of building components. Dynamic thermal characteristics. Calculation methods
Will supersede BS EN ISO 13786:2007

ISO 13789
Thermal performance of buildings. Transmission and ventilation heat transfer coefficients. Calculation method
Will supersede BS EN ISO 13789:2007

ISO 14683
Thermal bridges in building construction. Linear thermal transmittance. Simplified methods and default values
Will supersede BS EN ISO 14683:2007

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT – ADOPTIONS

14/30250433 DC
BS EN ISO 8503-5 Preparation of steel substrates before application of paints and related products. Surface roughness characteristics of blast-cleaned steel substrates. Replica tape method for the determination of the surface profile
Comments for the above document are required by 18 January, 2015

ISO PUBLICATIONS

ISO 630-5:2014
Structural steels. Technical delivery conditions for structural steels with improved atmospheric corrosion resistance
Will not be implemented as a British Standard

ISO 630-6:2014
Structural steels. Technical delivery conditions for seismic-improved structural steels for building
Will not be implemented as a British Standard

ISO 683-18:2014
(Edition 3)
Heat treatable steels, alloy steels and free-cutting steels. Bright steel products
Will not be implemented as a British Standard

ISO 1891-2:2014
Fasteners. Terminology. Vocabulary and definitions for coatings
Will be implemented as an identical British Standard

ISO 4995:2014
(Edition 6)
Hot-rolled steel sheet of structural quality
Will not be implemented as a British Standard