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# NSC

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May 2015
Vol 23 No 5

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Newport sees 2020 Vision

Wolverhampton gets Grade A first

Crescent transforms Hinckley

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**Cover Image**
Leeds Railway Station
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Netork Rail, West Yorkshire
Combined Authority
Structural engineer:
Mott MacDonald
Steelwork contractor:
William Hare
Steel tonnage: 370t

May 2015 Vol 23 No 5



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# Quality judging for design awards

Nick Barrett - Editor

Fourteen projects have been selected for the shortlist for the 2015 Structural Steel Design Awards – the 47th in an unbroken awards series highlighting the best of steel construction.

The Awards recognise the contribution that high quality structural design combined with world leading steel construction expertise can make to the built environment. They are also some of the most extensively judged, with all of the shortlisted projects being visited, which is not the case with all awards. The independent and expert judges are looking for evidence that the highest standards have been achieved and they even have the ability to decide not to make any awards if they don't feel any of the entries make the grade.

The shortlist this year shows the wide range of buildings and other structures that can take advantage of constructional steel's benefits, including offsite fabrication, flexibility, future-proofing and high levels of sustainability. All would be worthy award winners, but we will have to wait until the awards ceremony on 1 July to find out which have succeeded.

The wide ranging shortlist includes high quality facilities for what will be some of the leading musicians of the future at the Guildhall School of Music and Drama, a major retail development at Bargoed near Cardiff, the First World War galleries at the Imperial War Museum, and Heathrow Airport's new Terminal 2.

Other structures include a bus station in Stoke-on-Trent, a unique fan shaped opening bridge at Paddington Basin, a swing bridge at Greenwich Reach, and bus station canopies at Tottenham. Cycling stars of the future might now be training at the new Derby Arena.

These projects all provide facilities that will be enjoyed by generations to come. However, steel's flexibility and sustainability benefits mean that none of the steel used in these shortlisted structures – or any other steel structures - will be discarded to landfill or downcycled to inferior uses, all will be recycled over and over again.

## NSC in print again

A year ago NSC went completely digital as our publishers decided the time was right to see how readers and advertisers would respond to a digital only magazine, one that included video content and links to additional information, and that was easily readable on any mobile device as well as on laptops and desktop computers.

Having trialled digital only for a year, it has been decided to offer the magazine in its traditional paper format once again for those who prefer to read it that way. From the Structural Steel Design Awards special issue, the July/August issue, NSC will be provided in paper as well as the existing digital and website formats ten times a year.

Details of how to register to receive the paper version can be found in a story in this month's News section and elsewhere in the magazine in the June issue, the final digital-only issue. We will also be writing to all those who used to receive the paper version to explain the change and let them know how to make sure they receive paper copies in future, should they so wish.

NSC

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The role of the Editorial Advisory Board is to advise on the overall style and content of the magazine.

# Steel's flexibility highlighted by SSDA shortlist

The British Constructional Steelwork Association and Tata Steel have announced the shortlist for the 47th Structural Steel Design Awards (SSDA).

The 14 projects shortlisted showcase steel's flexibility and versatility in a number of different and varying applications.

The shortlist also reflects the wide geographical spread of steel's appeal for a variety of projects ranging from leisure facilities to high-rise commercial developments, with entries also received for a variety of bridges, houses and transport facilities across the UK.

The winners will be announced at an evening reception in London on 1 July.

The 2015 shortlist is:

**Milton Court,** Guildhall School of Music & Drama, London
**76½ Chartfield Avenue,** Putney
**Island Pavilion and Footbridge,** Wormsley Estate, Stokenchurch
**Heathrow Terminal 2B,** London
**Moorgate Exchange,** London
**St James's Gateway,** London
**Retail Development Plateau,** Bargoed
**First World War Galleries,** Imperial War Museum, London
**Derby Arena**
**Kew House,** Richmond
**Merchant Square Footbridge,** London
**City Centre Bus Station,** Stoke-on-Trent
**Greenwich Reach Swing Bridge,** London
**Tottenham Hale Bus Station Canopies,** London

# Billington Structures to supply steel for Next mega shed

Main contractor Bowmer & Kirkland has awarded Billington Structures the contract to supply 5,000t of steelwork for a mega-warehouse for Next in Doncaster.

The distribution centre at IDI Gazeley's 115-acre G.Park Doncaster includes a four-storey office structure and link bridge.

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

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

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

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

The project's plans also include a conveyor link bridge from the north eastern corner of the building to principally serve for the transfer of stock from the existing Next warehouse, across Holme Wood Lane.

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


# Windsor Park redevelopment continues apace

Windsor Park, Northern Ireland's national football stadium and home of Linfield FC is being redeveloped into an 18,000 all-seater capacity venue due to open this coming Autumn.

The scheme consists of replacing the South and East stands with new steel-framed structures,.

A phased construction programme is being employed and this will allow the stadium to remain open throughout the works.

The new stadium will meet UEFA stadium category 4 standards and will include a host of hospitality and refreshment outlets, media rooms, new changing rooms, ticket office and a museum.

Working on behalf of the main contractor O'Hare & McGovern, steelwork is being fabricated, supplied and erected by Gregg & Patterson.

# New Steel Construction returns to print format

After one year as a digital only publication, New Steel Construction (NSC) is reverting to a traditional paper format as from the Structural Steel Design Awards special issue in July/August.

Following numerous requests from subscribers and advertisers, we have decided to offer the magazine in its paper format once again for those in the UK and Ireland who prefer to read it that way.

NSC will be provided, free of charge, in paper as well as the existing digital and website formats ten times a year.

We will also be writing to all those who used to receive the paper version to explain the change and give instructions on how to make sure they receive paper copies in future.

To subscribe to the new paper format:

Existing digital NSC Subscribers should:

- Visit www.steelconstruction.info
- Login using the normal 'Login / create account' button in the top left corner
- Go to the 'Toolbox' sidebar menu on the lower left hand side
- Select 'My Profile'
- Tick the box to 'Receive printed NSC magazine', and enter your address details
- Click 'Save'

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- Click 'Save'

# Embassy rises up on Thames south bank

Steelwork erection for the new Embassy of the United States of America is taking shape on London's south bank.

The steel-framed structure is being built by a US/British joint venture between B.L Harbert and Sir Robert McAlpine. Approximately 3,000t of structural steel is being fabricated, supplied and erected by Severfield, with a further 900t of steel sourced by the project team via the USA.

Stability for the building is derived from a large centrally positioned core that also absorbs structural loads transferred via the floor slabs. Spans within the building are generally long – between 15m and 18m in length – producing a predominantly column free interior.

Designed by US-based architect Kieran Timberlake, the Embassy building will be a glazed structure with an outer scrim of ETFE cushions.

The façade will be orientated to provide shade, minimise heat absorption and protect the building from external environment while acting as a thermal buffer.

The project has been funded entirely from the proceeds of the sale of other US Government properties in London, including the present embassy in Grosvenor Square

The new 46,500m$^2$ embassy is expected to be complete by 2017.

# Jersey project banks on steel

A new premises for the Royal Bank of Canada in St Helier, Jersey is making full use of steel construction by utilising 2,000t of steel, a total that includes 1,000t of Westok cellular beams.

Main contractor for the six-storey office block is Dandara and it awarded Elland Steel Structures the contract to supply and erect steelwork as well as install metal decking and four precast cores.

"Due to tight access constraints on the site, the project has been split into four main phases and a number of sub-phases. This was necessary due to the very tight timescale between receiving construction status information from the structural engineer and steel being required at site," said Elland Steel Structures Commercial Director Jeremy Shorrocks.

The breaking down of the project into phases has made temporary stability of the steel structure an issue.

Elland Steel carried out a temporary stability study that culminated in the introduction of temporary bracing to stabilise the 26m high structure during erection.

## NEWS IN BRIEF

**Tekla** has launched Tekla Structural Designer, said to be a dedicated analysis and design software for structural engineers working on commercial building projects. The company says it complements Tekla Structures - extending the benefits of 3D modelling for engineers.

**Severfield** has signed a memorandum of understanding (MOU) with Nottingham Trent University providing a platform for learning and development of company employees and university students. The MOU also offers the opportunity for both parties to work collaboratively on research and development projects and will give university students the chance of work placements and long-term careers with Severfield.

The Derby Arena, the first new-build velodrome to be constructed in England since the 2012 Olympics, has been opened. Main contractor for the project was Bowmer & Kirkland and the steel was fabricated, supplied and erected by **Billington Structures**.

**Sherwin-Williams**'s Protective & Marine Coatings Europe, Middle East and Africa (EMEA) division will supply coatings for the new roof of the former London 2012 Olympic stadium. Working on behalf of main contractor Balfour Beatty, the roof steelwork is being fabricated and painted by **William Hare**, and it is estimated that more than 50,000 litres of Sherwin-Williams coatings will be required. The project is scheduled to be complete this summer in time to host five matches of the Rugby World Cup. West Ham United FC will relocate from its present home in Upton Park to the reconfigured stadium as from summer 2016.

Acrow Galvanizing (part of the **Wedge Group**) has begun constructing a new state-of-the-art £6M steel-framed facility in Haverhill, Essex. The company, which has been based in nearby Saffron Walden since the mid 1970s and employs 41 people, says the relocation is part of Wedge Group Galvanizing's commitment to enhancing its services. Approximately 220t of galvanized structural steelwork will be supplied and erected for the project by **TSI Structures**.

## AROUND THE PRESS

**The Structural Engineer**

***April 2015***

**125 years of steel bridges in Britain**

Steel has been the natural material for moveable bridges, and swing and bascule types have predominated.

**New Civil Engineer**

***2 April 2015***

**Retail Therapy**

[Broadway Westfield shopping centre] – "As with many retail developments, the Broadway scheme has undergone a number of design changes at the request of tenants and some have even taken place during the construction," says Keith Whitmore, Westfield head of design and construction. "Steel enables alterations to be made easily and this is why it is ideal for retail projects."

**New Civil Engineer**

***2 April 2015***

**Curving a library**

[The Curve cultural and learning centre, Slough] – Initially the Curve was to be built with reinforced concrete, but a redesign of the project, instigated by main contractor Morgan Sindall and involving Peter Brett Associates, resulted in the frame changing to structural steelwork.

**Construction News**

***17 April 2015***

**Shedding some light**

The first generation of 'big sheds' 20 years ago were frequently around 1,000m². Today, 3,000m² is the norm and gargantuan units of almost 10,000 m² are commonplace.

# BCSA and Tata Steel to host thermal mass webinar

The British Constructional Steelwork Association (BCSA) and Tata Steel will jointly host a free webinar entitled 'Thermal Mass in Buildings' on Thursday 21 May from 12.30 to 1.30pm.

Aimed at designers, architects and structural engineers, the webinar will be hosted by BCSA Sustainability Manager John Dowling.

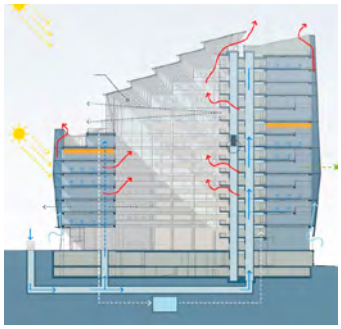
The topics to be covered in the webinar include: the history of thermal mass; how thermal mass works; technical issues in thermal mass; performance of different flooring systems in utilising thermal mass; limitations of thermal mass; case studies in the use of thermal mass, and the latest developments to enhance thermal mass.

Thermal mass is the ability of the fabric of a building to absorb and store heat. Effectively utilised as part of a whole building heating and ventilation strategy, it can reduce the energy required for cooling and, in some buildings, remove the requirement to provide air conditioning entirely.

In modern multi-storey, non-domestic buildings, the greatest accessible thermal mass is found in the concrete slabs that commonly form the upper floors.

The BCSA and Tata Steel say the aim of this webinar is to give designers an overview of the fundamental principles behind thermal mass and how it works.

Click here to register.



# Steel frame for Dublin car park is the cost-effective solution

Structural steelwork has been chosen as the framing material for a new £10.2M multi-storey car park to serve Terminal 2 at Dublin Airport.

Main contractor Balfour Beatty said a steel-framed car park was the design choice as it will help to create a lighter and more cost-effective structure than alternative materials.

The works, on behalf of 'daa' (previously known as the Dublin Airport Authority) comprise a four-floor structured steel extension to the current two-storey car park that will more than double the capacity of the car park to 2,386 spaces.

The new development has been designed to complement the existing car park facilities at the airport, which will remain open during the construction process.

Balfour Beatty Managing Director for Ireland Alan Garvin said: "Balfour Beatty has a long relationship with 'daa' having successfully completed a number of projects for them since 2006 and we look forward to continuing this relationship. We shall be using Building Information Modelling to provide a seamless interface between M&E, structural and civil design and to predict traffic flows enabling us to handover the car park efficiently for use."

Works on site will be complete in December 2015.

# Bridge provides Dundee with better waterside access

The £3M Seabraes Pedestrian Bridge has been successfully lifted into place and will provide the city of Dundee with improved access to the River Tay waterfront

Spanning the east coast railway line west of Dundee railway station, the bridge was slotted exactly into place with just millimeters of leeway at either end during an overnight rail possession period.

Main contractor Morgan Sindall designed the arched bridge, while the steelwork was fabricated, supplied and erected by S H Structures.

Brought to site in sections, the 70t bridge was assembled on site over a period of eight weeks. Prior to installation the anti-slip deck finish was applied and the glazed balustrade system installed which ensured that no further work would need to be carried out above the rail tracks.

Using a Liebherr LG 1750 lattice boom mobile crane, the bridge installation took two hours despite difficult weather conditions.

"Typically for structures crossing live railway lines one of the main challenges is working within a limited possession period, making meticulous planning and attention to detail essential to ensure the lift goes ahead on time and as efficiently as possible," said S H Structures Sales & Marketing Manager Tim Burton.

"Our preparation meant the lift went ahead according to plan with only strong winds and rain making the exercise a little more challenging."

Due to be operational in May, the bridge will give pedestrian, disabled and cycle access to the River Tay waterfront from the north of the town helping visitors avoid a 1.5km detour around the rail line.

The bridge also aligns with the recently constructed steps at Seabraes allowing for direct connection through the Seabraes development sites to the University of Dundee campus.

Footpath and cycleway facilities also permit connections to Dundee city centre and the popular west end residential district.

Convener of Dundee City Council's city development committee Will Dawson said: "The stunning design and strategic location of the new bridge will make it a landmark in the city in no time."

# Steelwork completed on St James's Market

William Hare has completed the steel erection for the prestigious central London St James's Market project.

Comprising two adjacent eight-storey steel-framed commercial buildings – 52-56 Haymarket and 14-22 Regent Street, the project required a total of 3,500t of structural steelwork.

The job forms part of a major 10-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.

The larger of the two buildings 14-22 Regent Street features a retained façade, allowing the new structure to fit seamlessly into its historic streetscape. Behind the façade a new steel-framed structure will accommodate 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 main contractor Balfour Beatty, William Hare started the steel erection programme last September.

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.

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.

# M1 motorway bridge scheme awarded

Balfour Beatty has been awarded the £9.3M scheme to build a new steel composite road bridge over the M1 for Leicestershire County Council through the Midlands Highways Alliance Framework (MHAF).

The 52m-long steel bridge will be supported by a pier located in the M1 central reserve. The project also includes the construction of approximately 350m of two lane single-carriageway roads, foot and cycle ways.

The project will connect the New Lubbesthorpe Sustainable Urban Extension (NLSUE) development to the road network in the east, and provide better access to local facilities and employment for thousands of people set to live there in the coming years.

Balfour Beatty Managing Director for the West Midlands Mike Reade, said: "Through this latest award we will demonstrate Balfour Beatty's ability to deliver vital transport infrastructure schemes while offering clear benefits to the local community. We have now secured £20m of work through the MHAF since 2014 and we look forward to delivering much more."

The project will be completed during the summer of 2016.

# Diary

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

**Tuesday 5 May 2015**
**EC4 Composite Design**
This course will cover the design of composite beams and slabs with reference to Eurocode 4 for composite construction (BS EN 1994-1-1).
London. For details click here

**Tuesday 12 May 2015**
**Fabrication Economics**
1 hour lunchtime webinar free to BCSA and SCI members, offering an overview of member design in portal frames.
1 hour webinar.

**Tuesday 19 May 2015**
**Portal Frame Design**
This course provide in-depth coverage of the major issues surrounding the analysis, design and detailing of portal frames.
Leeds. For details click here

**Thursday 21 May 2015**
**Thermal Mass in Buildings**
The aim of this webinar is to give designers an overview of the fundamental principles behind thermal mass and how it works.
For details click here

**Tuesday 9 June 2015**
**Steel Building Design to EC3**
This course will introduce experienced steel designers to the Eurocode provisions for steel design.
Manchester. For details click here

**Tuesday 16 June 2015**
**Crane Girders and Monorail Beams to EN 1993-6**
1 hour lunchtime webinar free to BCSA and SCI members, offering an overview of the design of Crane Girders and Monorail Beams to EN 1993-6
1 hour webinar.

**Tuesday 16 June 2015**
**Light Gauge Steel Design**
This course introduces the uses and applications of light gauge steel in construction, before explaining in detail the methods employed by Eurocode 3
Dublin. For details click here

**Thursday 18 June 2015**
**Steel Building Design to EC3**
This course will introduce experienced steel designers to the Eurocode provisions for steel design.
Newcastle. For details click here

**Thursday 25 May 2015**
**Portal Frame Design**
This course provide in-depth coverage of the major issues surrounding the analysis, design and detailing of portal frames.
London. For details click here

**Tuesday 30 June 2015**
**Essential Steelwork Design - (2 day course)**
This course introduces the concepts and principles of steel building design to EC3. (BS EN 1994-1-1).
Glasgow. For details click here

**Tuesday 30 June 2015**
**High Strength Steels in Long Span Structures**
This seminar will equip engineers with essential information for the effiecient design of long span structures such as stadia and exhibition halls made of high strength steel.
London. For details click here

# City gateway opens with steel


## Work to transform an area of Wolverhampton city centre into an international quality transport gateway has begun with steel construction playing a leading role.

Wolverhampton's ambitious plans to redevelop the city centre area around its main railway station are now in full swing as a new office block takes shape.

Known as the Interchange, the development will create a new gateway to the city, providing a modern transportation hub for buses and trains, as well as retail and office space.

The first phase saw a new bus station and an adjoining office block completed a few years ago. Phase two has now begun with the construction of a four-storey mixed-use building on the site of the city's old bus station.

With retail units on the ground floor, the structure's three upper levels will provide Wolverhampton with its first Grade A offices.

Aiming to achieve a BREEAM 'Excellent' rating, the steel-framed structure has been fabricated, supplied and erected by Leach Structural Steelwork working on behalf of main contractor Balfour Beatty.

Having commenced its onsite steel programme in January, Leach finished the erection process, which also included installing metal decking, a precast lift shaft and precast stairs, in late March.

Explaining the project's choice of materials, Curtins' Director Andy MacFarlane says: "As a team we chose a steel-framed design as it was the best option in terms of programme."

Steelwork was also the lightest option and this was an important consideration, as some of the project's foundations have to cantilever over an existing retaining wall that intrudes into the site.

The wall supports a bridge that carries the station approach road (Railway Drive) across the city ring road. Behind the wall there are a number of important service ducts, so moving or disturbing the retaining wall had to be avoided at all costs. A steel frame was consequently chosen at it exerts the least amount of weight on to the foundations.

Supported on piled foundations, the steelwork is based around a regular 7.5m grid pattern that gains its stability from moment frames, bracing and a centrally positioned lift shaft.

Cross bracing is located in stairwells, inside the lift shaft and along one of the building's gable ends.

Rectangular in plan, the structure features a four-storey element facing the main station thoroughfare, and an interconnected three-

*The development will contain Wolverhampton's first ever Grade A offices*

storey section at the back overlooking the new bus station.

The entrance to the building is housed within a curved frontage formed with facetted beams and curved channels along the parapet. This was deemed to be the most efficient way of forming the curved elevation, as the glass cladding panels will also have to be installed in a facetted method.

"Bringing materials to site has been very challenging on this site as we are hemmed in on all sides," explains Balfour Beatty Project Manager Peter Fennell. "This has affected the steel programme and meant Leach has had to use a just-in-time scheme for its steel deliveries as there is little room for material storage onsite."

The structure occupies nearly the entire footprint of the site and consequently Leach Structural Steelwork had to sequence the erection programme, from one end of the site to the other, so the final bays could be installed by a crane positioned just inside the site entrance.

"Working in this sequential manner worked really well, installing the stairs and lift shaft as the frame progressed," adds Leach Structural Steelwork Director Eric Leach. "None of the steel sections were heavier than 3t, with the longest elements being the 18m-high columns, so everything was erected by a 60t-capacity mobile crane."

## Further developments

Lead developer Neptune Developments and Wolverhampton City Council will soon begin work on refurbishing and extending the railway station's multi-storey car park adding a further 520 spaces, areas for bicycles and a new taxi rank.

Plans are also afoot to redevelop the entire railway station in 2016, extend the existing Metro line to the new station, and construct further commercial and retail structures.

Neptune Developments Managing Director Steve Parry comments: "The interchange is an important element within the overall scheme and the vision for a modern state-of-the-art transport hub in Wolverhampton city centre."

Councillor Peter Bilson, Wolverhampton City Council's Cabinet Member for Economic Regeneration & Prosperity adds: "The Interchange is a main gateway to the city centre and is a strategic regeneration priority for the council. The car park will be the next stage in creating a truly integrated transport hub. The existing multi-storey car park at the railway station is very dated and widely regarded as a bit of an eyesore."

The scheme has been designed by ASL architects and its lead architect Richard Cronin says: "This is the place where many people arrive in Wolverhampton and we to need create the best possible first impression. We have looked at similar projects elsewhere in the UK and internationally to achieve the highest design standards and create the best possible passenger environment in terms of quality, safety and accessibility. This is very much a piece in a bigger and emerging scheme, but is reflecting the values that underpin the Interchange vision."

***"Working in this sequential manner worked really well, installing the stairs and lift shaft as the frame progressed."***

*Steel was the best framing choice because of the confined site*

**FACT FILE**

**Wolverhampton Interchange**

**Main client:** Wolverhampton City Council

**Developer:** Neptune Developments

**Architect:** Austin Smith Lord

**Main contractor:** Balfour Beatty

**Structural engineer:** Curtins

**Steelwork contractor:** Leach Structural Steelwork

**Steel tonnage:** 340t

*An L-shaped covered street divides the central part of the scheme*

# City centre reborn with steel

**FACT FILE**
**Friars Walk, Newport**
**Main client:** Queensberry Real Estate
**Architect:** Leslie Jones Architecture
**Main contractor:** Bowmer & Kirkland
**Structural engineer:** Waterman Group
**Steelwork contractor:** Caunton Engineering
**Steel tonnage:** 6,000t

The large steel-framed Friars Walk development in Newport will create a new retail and leisure destination within a reconfigured city centre.

Newport in South Wales is undergoing a comprehensive programme of regeneration at the heart of which is the 2020 Vision, a masterplan of citywide schemes and projects that aims to deliver a more prosperous and vibrant city.

A central part of the city's regeneration is Friars Walk, a retail and leisure scheme currently under construction between the River Usk and Newport's existing main retail zone.

Director at Leslie Jones Architecture Brian Tracey says: "The scheme will revitalise Newport's existing retail offer through the creation of modern space and the provision of new leisure facilities. Friars Walk has been purposefully designed to reconnect a disjointed part of the cityscape and create a cohesive, attractive and accessible urban realm."

Friars Walk will deliver 36,000m² of retail and leisure space consisting of three main elements: a three-storey Debenhams anchor store, an eight-screen Cineworld complex and two main blocks of 37 double-height shop units set either side of a pedestrian covered street.

Topping the street is a curved tubular steel frame that supports ETFE lightweight cladding designed to accept the building movement differentials from the main steel frame. The tubular steel beams span the 11m wide street and are seated on large concrete

*The cinema and adjacent public realm will be a focal point of the scheme*

*"There are a number of different hand-over dates which we had to include within our steel programme"*

plinths located on the roof of the retail units.

The project also includes an undercroft 350-space car park, 13 restaurants arranged around a new public square and a new bus depot.

Although the Friars Walk scheme has been on the drawing board for some time, construction work only kicked off in early 2014. The site had already been cleared prior to Bowmer & Kirkland taking over, so after some initial groundworks the steel erection programme was able to start in June.

Steel erection began with the Debenhams store followed by the cinema complex, as these two structures have to be handed over first.

"Due to the various fit-out requirements, there are a number of different hand-over dates which we had to include within our steel programme," explains Caunton Engineering Contracts Director Grenville Griffiths. "We also had to phase the erection of the retail area around sewer relocation works." See box.

Steelwork for the three-storey Debenhams store is based around a 10m × 12m grid pattern. The adjoining retail mall, which features double-height shop units arranged in two large blocks either side of an L-shaped pedestrian street, sitting above a car park and large service yard, is predominantly based around a slightly smaller 8m × 7.5m grid. This column setting was chosen as the optimum spacing for both the car park and the retail accommodation above.

The only area in this part of the project that strays from this grid pattern is the basement service yard where a series of 25m span, full building height, Vierendeel trusses have been installed to create the large open area needed for delivery trucks.

The opposite end of the mall from the anchor store features a large public realm to be known as John Frost Square. The lower level that houses the car park under the mall features an array of restaurants around the square. Lifts and stairs link this area with the first floor retail zone and the adjoining cinema.

In order to construct the various sized cinema auditoria, the steel frame changes in this sector with a number of different spans.

"The longest beam we've erected in the auditorium fit-out spans 9m and weighed 1.5t," says Mr Griffiths.

Caunton completed the steelwork in April and Friars Walk is scheduled to open on 12 November.


## Steel frame

The entire project is formed by one large steel frame that is divided up into four building block units with designed movement separation joints at the interfaces.

The principal joints are to the Debenhams anchor store with the main retail mall blocks which has a central divide along the main high street, and the junction of the cinema block with John Frost Square.

Stability for the steel frame is gained from a combination of moment frames and bracing located in lift shafts and steel cores.

"Friars Walk needs to be delivered within a tight time frame. With this in mind, we designed the frame using steel as a user-friendly and adaptable product. This provided an agile frame for the exterior cladding, the design of which took inspiration from the surrounding Welsh landscape and Newport's historic architecture," says Director at Leslie Jones Architecture Brian Tracey.

"The exterior incorporates slate to the podium level while the retail and leisure blocks are clad in aluminium cladding and opaque glass, with brickwork to the street level façades."


***Steelwork erection has been phased around numerous groundworks***

## Sewer challenge

"We have two major sewers, each 5m deep, crossing the site. They both had to be replaced with one new sewer during our construction programme," explains Bowmer & Kirkland Project Director Tony Rides.

In order to complete the relocation of the sewers without hindering the project's tight deadline, the steel erection programme has been worked around these subterranean jobs.

The sewers run directly across the main centrally positioned retail mall, consequently Caunton has had to erect these areas in a phased sequence.

At five column locations ground level bridging beams had to be installed to span a sewer. This allowed the columns to remain true to the grid pattern, even though the piles were installed off-grid in order to avoid the sewer alignment.


*Z-shaped bracing is lifted into place*

# Steelwork takes a bow at Irish venue

A steel-framed extension to the Belfast Waterfront conference and entertainment venue is the biggest single project in the city's £150M investment programme. Martin Cooper reports.

The £29.5M extension to the Belfast Waterfront, Northern Ireland's only purpose-built conference centre, will double its existing conference, exhibition and entertainment space, which in turn will help to attract more international events and act as a catalyst for further economic growth.

The steel-framed extension links into the original concrete-framed Waterfront but the new build is a fully independent structure gaining stability from its own braced cores.

The extension is constructed over the existing service yard between the Waterfront Hall and the adjacent Hilton Hotel, and also extends outwards along the River Lagan embankment.

Inside the extension there will be 4,000m² of conference, exhibition and banqueting space. This will consist of two


*How the completed venue will look*

exhibition and conference spaces, hall 1 incorporating halls A, B, C and D, that can be used as one large 1,850m² area, or sub-divided via retractable walls into four smaller spaces. Likewise the smaller hall 2 can also be divided into two separate halls, A and B, or used as one 702m² exhibition and conference area.

Elsewhere there are a number of flexible breakout meeting rooms, many of which can also be divided into numerous smaller configurations. The extension also includes a fully fitted-out commercial kitchen to cater for up to a 750 person banquet, plant and back-of-house zones, circulation routes and a new feature riverside entrance and foyer.

Main contractor McLaughlin & Harvey started work onsite last September and in 86 weeks the project will be complete with the first events pencilled in for May 2016.

"This is a very fast-track programme mainly due to our funding obligations," explains Belfast City Council Project Manager Kieran Mooney.

"Nearly half of the project's funding is coming from the European Regional Development Fund (ERDF) and it stipulates that the money must be spent during 2015 and so the project will be complete by 31 December."

No pressure then on the construction team! To their credit the scheme is on schedule despite a whole host of challenges that have had to be overcome.

Enabling works and piling was predominantly completed last year, but not without a major service diversion scheme having to be undertaken first (see box).

Walter Watson started its steel erection programme in January and it is scheduled to complete this in June.

"The main challenge for us is the coordination of the programme between ourselves and groundwork and envelope

**FACT FILE**
**Belfast Waterfront extension**
**Main client:** Belfast City Council
**Architect:** Todd Architects
**Main contractor:** McLaughlin & Harvey
**Structural engineer:** Doran Consulting
**Steelwork contractor:** Walter Watson
**Steel tonnage:** 1,200t

works. Due to the restricted nature of the site the steelwork erection had to commence at one end of the site while groundworks continued on the remainder of the site," says Walter Watson Project Manager Trevor Irvine.

This requires a high degree of co-ordination between the subcontractors to allow passage of plant and materials through the areas where excavations are ongoing and foundations are still under construction.

Further site restrictions arise due to the close proximity of both the Waterfront and the Hilton Hotel, with noise and vibration being kept to a minimum and continuously monitored.

The initial steelwork erection was carried out over the existing Waterfront service yard that is situated adjacent to the Hilton and is not being used during the duration of the construction work.

This area has the longest spans of the project, as the grid is 23.5m × 6m in order to accommodate turning trucks once the service yard is back in operation.

Spanning this ground floor area and supporting hall 1 A and B above is a series of plate girders varying in depth from 1,500mm up to 1,800mm.

The heaviest girder on the entire scheme is located here and it weighs 21.7t. This 19m-long section has connection plates that have a combined weight of 3t and required 70 bolts.

"The long spans required over the service yard, and the need to absorb big floor loadings and high frequency vibration from the hall above, meant stiff steel plate girders were the only option," explains Doran Consulting Project Engineer Andrew Gardiner.

Forming the roof of the expo halls is a series of 23.5m-long tapered Westok rafters and secondary beams erected on a 3m × 3m grid.

The stiffness of the steel frame is very important, not just here but also in the extension's other halls. The floors have to be able to absorb 10kN per m², while the roof steelwork will have to support rigging and exhibits weighing up to one tonne apiece.

Due to the project's phased programme Walter Watson has also started erecting the eastern corner of the extension, overlooking the river.

On this part of the steel frame there are a number of large cantilever trusses, 1,250m deep and cantilevering out to a maximum length of 9m to form a feature element of the structure.

"With steel erection gangs working simultaneously, they will eventually meet up in the middle of the site. In this way we can keep the site accessible for our many other ongoing works," sums Mr Donnelly.

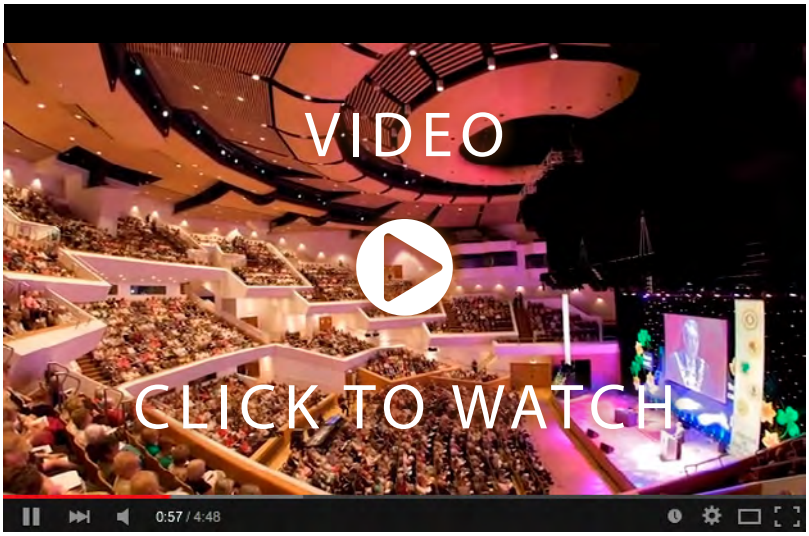
## On site services

'The site has every kind of service crossing it," explains McLaughlin & Harvey Contracts Manager Shaun Donnelly. "Gas, electricity and a BT fibre-optic cable, feeding a number of high-profile locally-based companies, all had to be diverted to the edge of the site."

There is also a main sewer running beneath the site and diverting this would have been time-consuming and expensive. However, actually locating it proved to be very challenging exercise as historical plans of the site proved to be unreliable at best.

"We tried surveying the area but this couldn't accurately pinpoint the sewer, so we had to excavate down 4m to expose the pipe all the way across the site," adds Mr Donnelly.

Plotting the exact course of the sewer was critical for the piling installation, as some of the site's 18m-deep CFA piles have had to be installed within inches of the pipe and hitting it with a pile would have been disastrous.




*A temporary column supports a feature 9m cantilever and will be removed later in the programme*

# Entrance arrives at station

A portal-framed entrance structure, built over the River Aire, will help alleviate passenger congestion at Leeds station. Martin Cooper reports.

**FACT FILE**
Leeds Railway Station, new southern entrance
**Main client:** Network Rail, West Yorkshire Combined Authority
**Architect:** AHR
**Principal contractor:** Carillion Rail
**Structural engineer:** Mott MacDonald
**Steelwork contractor:** William Hare
**Steel tonnage:** 370t


*Steel arrives by barge for the construction of the entrance frame*

Leeds city centre is changing fast with numerous new and modern office developments helping it take on a dynamic post-industrial look.

Many of these new office schemes have been built in an area to the south of Leeds station and, in turn, they have created a demand for the new pedestrian station entrance currently under construction.

The existing main entrance is situated on the north side of the station and so commuters walking from the southern commercial schemes regularly cause pedestrian congestion on the pathways leading around the station. It has been estimated that up to 20% of the city's rail passengers will benefit from and use the new entrance.

Available space for a new entrance to the south of the station was extremely limited and, as the design had to incorporate access to the existing high-level concourse, a location that straddles the River Aire was the only option.

It may be the right choice of location but the new entrance's site has presented the project team with a host of challenges.

"We're building over water and so we have river safety issues, and apartment blocks on two sides mean the site is very constrained. The site also requires a large 63m-high tower crane which has been subject to numerous wind stoppages," explains Network Rail Project Manager Luan Anderson.

"We are also working next to, and at times over, live rail lines so some of our work can only be done during night-time possessions."

Prior to the erection of the steel-framed entrance superstructure, principal contractor Carillion Rail had to first install piled foundations and two concrete piers in the middle of the river (see box).

The piers are positioned and aligned with the existing rail viaduct arches so as not to impede the flow of the river during heavy rain. This has resulted in the requirement for a steel transfer structure at river deck level to support the primary superstructure columns of the new entrance, as they do not align with the piers.

The transfer deck represented William Hare's initial phase of the steel erection programme. The steel was installed via the on site tower crane lifting the members off barges and positioning them directly between the new piers.

The transfer deck comprises a series of galvanized beams, positioned at 1.8m centres. The beams span 10.2m between the new concrete piers and cantilever a further 3.5m beyond the centre line of each pier providing support to the columns above, as well as support to an access and maintenance deck around the perimeter of the building base.

The beams bear directly onto each pier via a simple baseplate connection. A series of beams cantilevers 2.3m beyond the southernmost primary beam to complete the curved plan profile of the deck.

"The main reasons why a steel deck was specified were the benefits brought by offsite fabrication and speed of erection to reduce the construction time above the river, which was considered to be a positive health and safety decision," says Mott MacDonald Project Manager Jon Svikis.

Holorib metal decking fabricated and cut to size offsite spans between the beams and provides permanent formwork from which to safely fix reinforcement and pour a 160mm deep concrete floor slab. Pockets were left in the slab ready to receive the superstructure columns and vertical bracing.

Extending from the transfer deck is a new suspended floor and escalator pit that extends through the existing masonry arch. The floor structure comprises two upstand trusses that span 15m and are 2.1m deep.

Sitting on the transfer deck, the entrance superstructure comprises a series of portalised arches at 1.8m centres.

"The close spacing is to allow the structural zone to be minimised, reduce the load on each transfer beam at river deck level, and to allow the sweeping, curved roof geometry to be achieved without the need for a secondary frame, thereby minimising the overall cladding build-up and maximising the internal space available," says Mr Svikis.

The portals are a maximum of 20m tall, with a horizontal span of approximately 12.5m. Each frame comprises two vertical legs and a curved arch section of varying radii of between 2.8m and 12.3m.

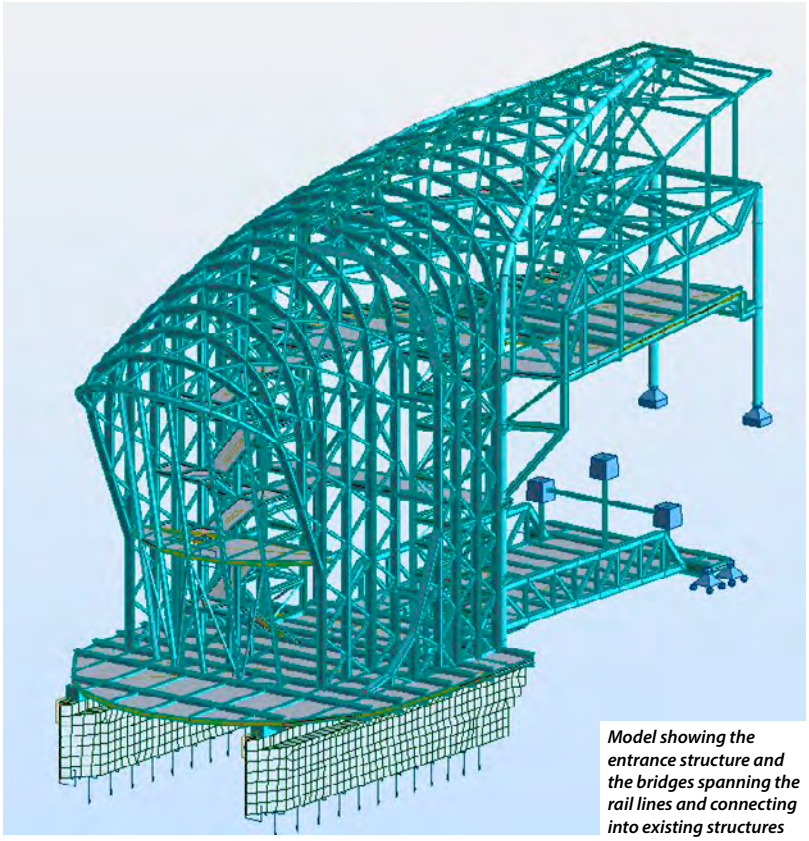
Generally the frames are being erected in four pieces. The frames are braced out of plane via a series of SHS members, forming an inherently stable 'diagrid type' structure. In-plane stability is provided via moment action of the individual frames, as well as via the 20m-high braced lift shafts ▸18

## River work

The location of the site means much of the work revolves around the River Aire. Carillion Rail has its main compound and an assembly yard about 1km downstream at Water Lane. Much of the project's materials arrive at this yard and are then delivered to the project by barge as this is the easiest way to access the site without negotiating the surrounding narrow streets.

"One of our initial tasks was to assemble a jack-up barge and float it to the site," explains Carillion Project Manager David Carlyle. "At 18m wide the barge provided a working platform for our 26t piling rig and an area from which we constructed the two concrete piers."

Steelwork contractor William Hare is also delivering all of its steel to the site via Water Lane, using a number of pontoons that can be configured to suit the length and weight of the steel members.



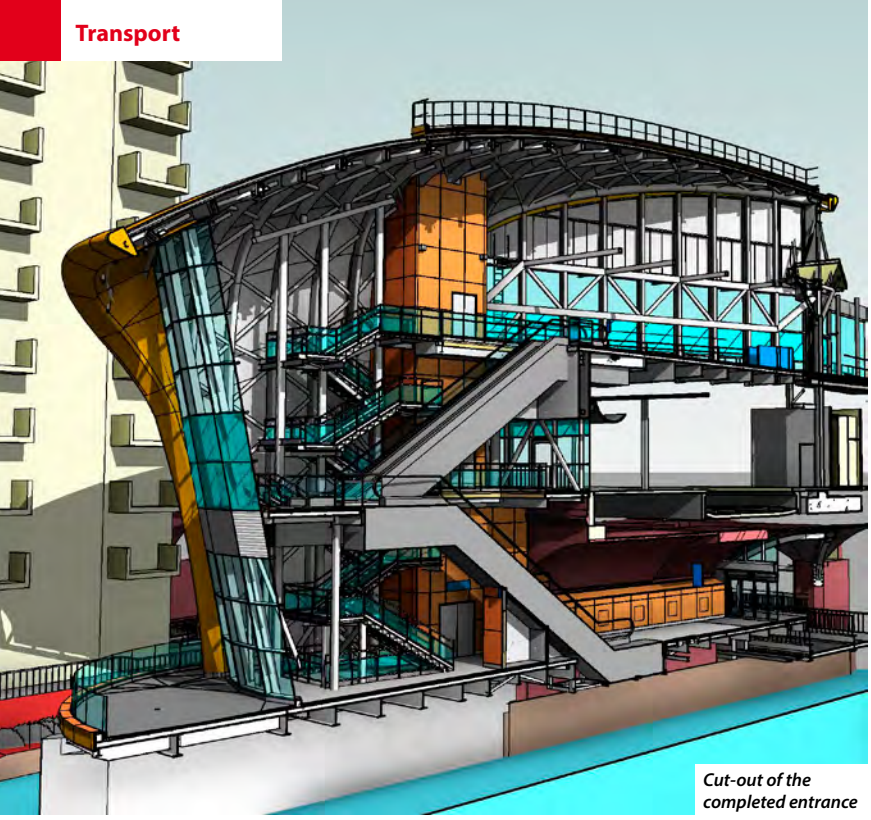
*Model showing the entrance structure and the bridges spanning the rail lines and connecting into existing structures*

## Footbridges

There are two external footbridges that will provide access for passengers from the east and west riverbanks into the new entrance, as well as two further bridges/ramps leading into the viaduct arches.

The eastern footbridge spans 9.5m, while the western bridge spans 12.8m. Both bridges are welded structures comprising two primary box sections supporting an arrangement of stiffened deck plates and secondary sections.

The eastern bridge will be brought to site as one fully completed element and craned into position, while the western bridge will be brought to site in two pieces. This is due to the crane lifting capacity restrictions. The shorter section will be temporarily propped before the larger section is craned into position. The two elements will then be spliced together insitu above the river.



Cut-out of the completed entrance

Existing arches have been strengthened with steelwork

Steel waiting to be loaded onto barges at the Water Lane yard

17 that are positioned to the north adjacent to the existing masonry viaduct. There are 11 frames at river deck level; with a further nine frames extending above three existing railway lines to form the connection with the high level concourse.

This involves construction of a new 'Ticket Barrier level' above platforms 15,16 and 17, crossing three electrified railway lines. The new ticket barrier level concourse is hung from two primary trusses that span across the lines and were installed during weekend rail possessions. The eastern truss spans 17.7m and is 1.9m deep, while the western truss spans 19.5m and is 2.3m deep.

To help support the concourse extension a new column has been introduced on platform 15 on top of the existing Victorian masonry viaduct.

This has meant one of the viaduct's arches had to be strengthened with four plate girder ribs arranged in a cruciform. The steelwork is packed tightly to the existing masonry arch using high strength cementicious grout. The steel sections are 365mm deep and 325mm wide, fabricated from 45mm plate for the flanges and 25mm plate for the webs. Each of the four ribs is bolted into the existing masonry pier at the springing point via 1m deep haunches and 40mm thick end plates.

As well as the access points from the high level concourse, low level access to the new entrance will be provided by two footbridges (see box) spanning from both banks of the river and ramps leading into Dark Neville Street within the viaduct arches.

Leeds station southern entrance is due to be completed this autumn.

## Steelwork for the new south entrance to Leeds station

Dr Richard Henderson of the SCI

The structure of the new south entrance consists of curved 400 mm × 200 mm RHS rafters on RHS columns of the same size, forming a series of portal frames. In elevation, looking from the south, the curved beams have a number of different radii to form the required roof profile and are closely spaced, matching the spacing of the transfer deck beams which support them. The portal frames are designed elastically with pinned feet for strength, but some fixity is assumed to control the lateral deflection when considering serviceability.

The columns are closely spaced to eliminate the need for secondary structure spanning from frame to frame to support the cladding: the cladding itself is sufficiently strong and stiff to span the 1.8m between frames. Perpendicular to the plane of the portal frame, the frames are connected together with bracing which forms a diagrid over the whole of the vertical sides and the curved roof. The structure is very stiff out of plane and the diagrid ensures load-sharing between the transfer deck beams. Lateral loads are also shared between the diagrid and lift shafts next to the existing masonry arches of the existing railway platform structure. It was a design requirement that the new structure is structurally stable independently of the existing structure.

The portal frames were divided into four pieces for manufacture and transportation, consisting of the two straight legs and two curved pieces forming the rafter. The splice in the rafter occurs at the highest part of the curve. All splices carry axial and shear forces and bending moments as in traditional portal frames.

The cladding wraps tightly round the structure as already described. To prevent the connections in the portal frames from intruding into the cladding zone, conventional "pipe flange" type splices with end plates projecting beyond the envelope of the RHS were avoided. Instead, transition pieces formed of shallower open sections were welded to end-plates closing off the RHS elements. End-plate splices to these transition pieces were then detailed within the RHS profile, avoiding the encroachment into the cladding zone. The curved rafters were bolted together in the assembly yard, brought to site by barge and lifted onto the columns as a single element. The curved beam-to-column connections were made in position.

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# Retail spurs regeneration

## A large town centre development is benefiting from steel construction's ease and speed of construction.

**FACT FILE**
**The Crescent, Hinckley**
**Main client:** The Tin Hat Regeneration Partnership
**Architect:** TP Bennett
**Main contractor:** Bowmer & Kirkland
**Structural engineer:** Clark Bond
**Steelwork contractor:** Billington Structures
**Steel tonnage:** 2,000t

The Leicestershire town of Hinckley is being transformed as a multi-million pound mixed-use development rapidly takes shape.

Known as The Crescent, the project occupies a large swathe of the town centre and will ultimately deliver a large 6,500m² Sainsbury's superstore, more than 25 smaller retail outlets, a five-screen Cineworld complex, a revamped bus station and a 550-space undercroft car park.

Commenting on the project, Leader of Hinckley and Bosworth Borough Council, Stuart Bray says: "This represents a significant investment in Hinckley that will bring a great deal of new employment and prosperity to the town."

Work commenced on the project during the summer of 2014 when main contractor Bowmer & Kirkland began a phased demolition and groundworks programme.

This work continued into the New Year as approximately one-third of the site could only be handed over to the project team in January.

As well as the challenge of phasing much of the work, the topography also presented another challenge.


The site incorporates a steep slope and so a large retaining wall has had to be constructed across the mid-point of the site. This allows the ground floor level to stretch seamlessly across the entire site, with only a few minor pedestrian steps, while within the retaining wall the project has a basement level accommodating the car park.

"When the steel erection commenced it had to be phased around the groundworks, especially the construction of the retaining wall," explains Bowmer & Kirkland Senior Site Manager Guy Laughton.

Steelwork contractor for the project is Billington Structures, who was awarded a design and build contract for all of the Crescent's structural frames.

The initial steelwork phase involved Billington Structures erecting the 6,700m² Sainsbury's store (Block E) that sits atop an undercroft car park.

Steelwork has been designed and erected around a large 7.5m × 16m grid pattern, which is ideal for the car park and the superstore above.

A series of 16m-long cellular beams form the roof of the car park, chosen for their efficiency and for the fact the beam's openings allow extra light into the undercroft car park. The beams support a 150mm thick diaphragm deck, which is the floor of the superstore.

Structurally the Sainsbury's store and

The Sainsbury's store and parts of Block B (right) take shape

A view of the cinema from the Sainsbury's store

car park is one large braced frame that incorporates a first floor service yard in one corner. Because of the extra loadings that will be produced by trucks using the yard, a series of 10t 16m-long plate girders have been used instead of cellular beams in this part of the frame.

Block E is structurally independent from the adjacent retail Block A although, once clad, they will look like one continuous building.

Because of its length, the braced frame of Block A is split in half by a row of double columns forming a movement joint. Sitting opposite and forming the other side of the pedestrian street, Block B is also split in half by a movement joint for the same reason.

Block A was the zone where the steel erection programme had to be phased around the construction of the retaining wall. Three of Block A's retail units closest to Sainsbury's were erected along with Block E, with the remainder put up later in the schedule once the wall was completed and backfilled.

Billington Structures erected Block E and those parts of A using two 60t-capacity mobile cranes, both working in such a way that the two gangs didn't block themselves in as there was only one access point for delivery of materials.

ASD Westok value engineered the frame on Blocks A and E, alongside Billington Structures. This ensured the greatest design economy was achieved in the structural steelwork solution.

ASD Westok Design Team Leader John Callanan says: "There were a number of design constraints to understand. This complex job involved strict beam depth restrictions arising from the site topography and load-transfer arrangements with columns sitting on both secondary and primary beams in Block A.

"Along with this, there are a raft of varying loading conditions to design for, including retail, back of house, service yard, roof and rooftop plant loading areas.

"Structurally optimised ▸22

Block B will front the new bus depot

*The cinema block has been one of the most complex parts of the steel programme*

21

asymmetric cellular beams were ideally suited to the long-span grids. Plated transfer beams were designed for the transfer sections."

The next substantial part of the steel package to be erected was the cinema complex on the opposite side of the site from Sainsbury's.

Some other smaller retail units, between Sainsbury's and the cinema, have been erected; most notably parts of Block B that forms the 'Crescent' around which the new bus station will be located. Otherwise much of the steelwork in the middle of the site is being erected now (May), phased around the remaining piling and groundworks programme.

The cinema (Block C) is another stand-alone steel braced structure and it contains retail units on the ground floor and five cinema auditoria above.

*"Structurally optimised asymmetric cellular beams were ideally suited to the long-span grids. Plated transfer beams were designed for the transfer sections."*

As the retail units and the five auditoria are all of different sizes, the grid pattern for this structure is very complex and changeable.

A single mobile crane erected the cinema steelwork with the programme beginning in January and completing in March. The work also included the installation of precast stairs as well as the auditoria's seat terracing.

The steel erectors had to leave sections of the roof out to allow the stairs and terracing units to be lifted in. It was very complex as the terraces had to go in last as they are supported on rakers that, in turn, are supported by columns that support the entire structure.

Included in Billington Structures' design and build contract was the design of a bespoke terracing system for the cinema auditoria.

The design for the seating had to be steel and each of the terrace banks is curved in plan. Billington's solution was to form each step with curved plated sections, which were brought to site in two pieces and bolted together during installation. The plated sections in turn support metal decking and a thin concrete topping to complete the terracing.

The Crescent is scheduled to open in time for Christmas 2015.

*Cellular beams form the car park*


*Visualisations of the completed Crescent scheme*

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# Steel is ready for BIM

The steel construction sector is ahead of the game as far as implementing the use of Level 2 BIM before next year's Government deadline. Nick Barrett reports.

Construction's biggest client - the Government - demands that all of the projects it funds use Level 2 Building Information Modelling (BIM) by next year. The 2016 deadline applies to Northern Ireland projects procured by its Centre of Procurement Expertise (CoPE), Scotland has until 2017.

This demand, announced in 2011, set the construction industry off on a mission to find software and people with experience in using BIM. Along the way major issues have seemingly arisen in relation to matters like insurance, copyright, commercial confidentiality and the industry's ability to work in the collaborative ways implied by BIM. Doubters about the industry's ability to be ready in time have regularly surfaced.

Steelwork Contractors have been in the enviable position of being able to take a more sanguine view than most as they have in fact been using the type of 3D modelling and design software that will be commonplace when a project is BIM driven for many years.

Dr David Moore, Engineering Director of BCSA said: "One of the reasons that Steelwork Contractors are ready for BIM is their use of 3D modelling and their ability to work in an electronic environment. Steelwork Contractors have been using 3D modelling for many years, are familiar with the software and have the necessary IT systems, skilled people and the processes in place to embrace BIM now.

"The software appropriate for BIM is any software application that can manipulate objects and has the ability to import and export data to other software applications being used by other members of construction teams.

"Steel-framed structures are well suited to the BIM process as individual steel members can be clearly identified and objects allocated to them easily"

Dr Moore says a key aspect of BIM is the transition from working with documents to working with data by using the digital environment where information is recorded and stored electronically. This aspect of BIM requires a platform to store and share data, he explains. "Web-based software can be used as a service platform to store and share electronic project-related information between different members of the project team working in different locations. This technology replaces sets of data held locally by individual members of the project team and allows authorised team members access to the relevant information."

Each key member of a project team, including the Steelwork Contractor, will be required to produce a 3D model of their scope of work (i.e. in the case of the Steelwork Contractor the steel frame) based on the original model provided. The individual 3D models developed by each key member of the project team are then transferred to a single electric platform, which is usually managed by the Principal Contractor, where they are linked together to create what is known as a 'Federated Building Information Model'.

Dr Moore says: "Linking the models this way allows each project team's members to work with related data in using their own 3D software. It also provides a means to coordinate the design and to detect any clashes."

During a BIM project there are a number of key information transfer requirements at a variety of different stages in the construction process. During the design and delivery process the exchange of information to the Steelwork Contractor from the Principal Contractor is likely to be in a variety of formats. Although all the information will be electronic format, some information will be contained within 3D models and other information in 2D pdf documents.

At the handover and close-out stage all necessary information about the steelwork should be included in the handover documentation. The information provided at this stage will again comprise both 3D

## The Curve cultural and learning centre, Slough

"Our expertise in BIM and 3D modelling using Tekla software has been a great benefit on this project, enabling us to integrate the original architect's model with our own," says Caunton Engineering Contracts Manager, Phil Ratcliffe.

Working on behalf of Morgan Sindall, steelwork contractor Caunton Engineering has erected 370t of steel for this highly complex project.

As its name suggests this structure is a steel-framed curved rectangle in shape and plan. Each of the building's elevations feature either cantilevers or sloping and curving façades, with the main north side presenting the most striking aspect with a long sweeping, predominantly glazed, elevation looking on to the adjacent listed St Ethelbert's Church.

The three-level building is 89.7m long, 15.5m high and has a width which is 34m at its maximum and 16.5m at its narrowest. With an overall floor space of 4,500m$^2$ the centre will include a library, café, office space and a 280-seat performance space.

Constructing a building with this kind of complex shape brings with it a whole host of geometry and setting-out challenges. The use of a BIM model, shared between the entire project team made the design process less onerous.

Peter Brett Associates Project Engineer, Mark Way adds: "BIM was the best solution as it allowed everyone to see the same model, and this made it possible to detect any possible problems well in advance."

model information and supplementary 2D pdf documentation. This information will be in three sections:

- 3D model files
- Documents and 2D drawings
- COBie-UK-2012 data

### 3D Model files

3D BIM files should be as-constructed and provided in a suitable format. The as-constructed model should represent the as-constructed project in content and dimensional accuracy. This does not mean that models need to be updated to reflect deflections and construction which is within the allowable tolerances, but any construction or manufacture which is out of tolerance should be updated within the model. 3D clash files should also be issued.

### Documents and 2D drawings

2D drawings should be updated to reflect the as-constructed state and issued as 2D pdfs. As the BIM process develops it is possible that some Clients may not require 2D drawings to be issued at the handover stage.

Key non-geometric information for steelwork which may be included within the 2D drawings set may include:

- Member schedule
- Material grade
- Material sub-grade

Non geometrical information which is required to be provided in addition to 2D drawings and issued electronically in pdf format will typically comprise:

- Manufacturer's operation and maintenance documentation
- Testing and commissioning records
- Health and safety information

### COBie-UK-2012 data

Construction Operations Building Information Exchange (COBie) is a data format focussed on delivering non-geometrical building information such as schedules of proprietary items and product data sheets, warranties, test certificates and commissioning information and other non-geometrical building information. It is likely that Steelwork Contractors will not be required to provide COBie information, but the Steelwork Contractor should clarify the extent of the information to be provided at contract award.

Dr Moore concludes: "We should remember that the 3D modelling aspects of BIM uses design software, not drawing software and not BIM software. There isn't a specific BIM software, and the sort of software that Steelwork Contractors have been using for many years has all the capabilities required.

"The steel sector is ready for BIM and there is no reason why the rest of the construction supply chain shouldn't be ready in time to meet the government's deadline."

## St James's Market

A BIM approach has ensured the prestigious St James's Market project in central London is progressing efficiently and on schedule.

Working on behalf of main contractor Balfour Beatty, William Hare has erected 3,500t of steel for the two adjacent eight-storey commercial blocks that constitute the St James's Market project.

Known as 14-22 Regent Street and 52-56 Haymarket both buildings have made extensive use of fabricated cellular beams. These sections have 350mm deep holes to accept the services within their depth, as well as being stiff enough to span the required grids which are up to 18m.

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

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

Getting the entire team to buy into a BIM approach is something William Hare's Project Engineer Adam Suthers agrees with: "It takes more than just a BIM model, it requires collaborative BIM personnel which is what we have on this project."

*All images courtesy of A C Bacon Ltd*

# Agricultural Buildings designed to BS 5502-22

David Brown of the Steel Construction Institute highlights some of the important changes in the 2013 Amendment to this Standard.

## Agricultural Buildings

The first interesting point about agricultural buildings is that they are generally exempt from the England and Wales Building Regulations. If they are not used as a dwelling, not close to a building with sleeping accommodation and have sufficient fire exits, then no reference to the Building Regulations is required. This means that no structural design calculations will need to be submitted for review. In Scotland, the requirement for a building warrant means that the design must be approved by a qualified structural engineer.

Agricultural buildings do have their own design Standard – BS 5502-22:2003, which was amended (generally to reflect the introduction of the Eurocodes) in 2013. BS 5502-22 contains much interesting information, such as animal weights and the density of stored materials. Who would know that "heavy hogs" are six times as heavy as "weaners" or that cauliflowers are 50% denser than cabbages (but have the same angle of repose, when stored)? The Standard also has important information for the structural engineer responsible for the steel frame.

## Building Class

The previous version of the Standard had four different design classifications, but in the 2013 Amendment, this was reduced to just two classes. Clause 14.1 advises that (subject to some exceptions) most agricultural buildings should be designed as Class 2, which has a minimum design life of 20 years and reduced loading, as will be seen in the following sections of this article.

Table 1 of BS 5502-22 notes that the consequence of collapse is greater in buildings or structures of larger classification number, but perhaps this should really be the "probability" of collapse is greater.

## Structural Design

According to clause 16, structural design should conform to the relevant Eurocodes. Of most interest are the imposed loads on the roof, and the fact that design loads are to be based on classified loads, rather than loads as determined from the appropriate part of BS EN 1991. Classified loads are the characteristic loads (from BS EN 1991), multiplied by a classification factor, which for a Class 2 agricultural building is 0.9. For Class 1, there is no reduction. Class 1 buildings are really no different to any other structure.

Structural steelwork is to be designed in accordance with BS EN 1993. In the author's opinion, it is interesting that for structures covered by the Building Regulations, the Eurocodes are only one way to satisfy the requirements – Approved Document A specifically notes that it may be possible to demonstrate that the use of withdrawn Standards continues to meet the Requirements. However, for agricultural buildings, where one might observe that the design requirements are less onerous, the Eurocodes are the only design Standards cited in BS 5502-22; withdrawn Standards such as BS 449 and BS 5950 are not to be used.

BS 5502-22 has advice on light gauge steel purlins and cladding. Purlins may be hot rolled members, and simple size

provisions are given for angles and rectangular hollow sections. The Standard helpfully reminds designers that purlin resistance depends on restraint to the compression flange and that this may not be the case if fibre cement sheeting is used.

## Loading

Loading is covered in clause 15. The introduction to the clause indicates that in some cases, the specified loading is based on experience. From clause 15.1.1: *"Not all the values given have been obtained from statistical studies, but they are based on figures used by engineering designers for many years".* Wind loads are to be determined from BS EN 1991-1-4, so there is no evading this complexity.

## Roof loads

Imposed loads on roofs deserve a special mention, as they can appear relatively low compared to 'normal' design. For Class 1 buildings, the imposed load on the roof should be taken from BS EN 1991-1-1 and will result in the familiar figure of 0.6 kN/m$^2$. For Class 2 buildings, where there is no access to the roof except for necessary cleaning and repair, the uniformly imposed load on the roof should be taken as 0.4 kN/m$^2$ as a maximum value. This value is taken from Table 6.10 of BS EN 1991-1-1.

In common with all buildings, the snow load is identified separately from the imposed load, and should be determined from BS EN 1991-1-3 and the UK National Annex. As a reminder, the Eurocode approach to loads on a roof is that imposed loads are not combined with either wind or snow (clause 3.3.2(1) of BS EN 1991-1-1). This means that typical combinations of actions are:

- Permanent and imposed roof load
- Permanent and snow
- Permanent and snow and wind (either wind or snow as the 'leading' variable action)
- Permanent and wind (uplift)

For Class 2 buildings, all loads are reduced by the classification factor of 0.9. A comparison of typical 'gravity' design loads between Class 1 buildings and Class 2 buildings is given below. The permanent actions are assumed to be 0.15 kN/m$^2$. It is assumed that the snow load is less than the imposed load on the roof.

### *Class 1 buildings*

$1.35 \times 0.15 + 1.5 \times 0.6 = 1.1$ kN/m$^2$

### *Class 2 buildings*

$0.9 \times (1.35 \times 0.15 + 1.5 \times 0.4) = 0.72$ kN/m$^2$

The design load for a Class 2 agricultural building is therefore around 65% of the 'normal' design load – which is a reflection of the reduced design life.

## A word of warning

Although BS 5502-22 has specific provisions addressing reduced loading for Class 2 agricultural buildings, it seems obvious to say that all other requirements for good engineering remain in force. For agricultural buildings, which may be open-sided, or have no opportunity for bracing in one or more elevations, or may have timber purlins, the requirements to providing a stable, robust structure with appropriate restraint to members may be more challenging than for the steel frame in an equivalent fully clad industrial unit. Despite their exemption from the Building Regulations, the overarching requirement for sound engineering remains.

# AD 387
# Elastic critical moment and correction factor *g* for bi-symmetric I sections

Some SCI members have recently been asking questions about the variety of expressions available to calculate the elastic critical moment, $M_{cr}$. For some reason, members have been enquiring about the use of the correction factor, *g*, which appears in expressions provided in certain resources and is omitted in others.

This advisory desk note provides guidance/clarification on $M_{cr}$ and *g*.

The most general expression, for bi-symmetric I section is given in various resources, including SN002[1], as:

$$M_{cr} = C_1 \frac{\pi^2 EI_z}{(kL)^2 g}\left(\sqrt{\left(\frac{k}{k_w}\right)^2 \frac{I_w}{I_z} + \frac{(kL)^2 GI_t}{\pi^2 EI_z} + (C_2 z_g)^2} - C_2 z_g\right)$$

Of interest in this Advisory Desk note is the correction factor, *g*, which appears in the first part of the expression.

Correction factor *g* allows for initial in-plane curvature of the beam. The value of *g* is given by:

$g = \sqrt{\left(1 - \frac{I_z}{I_y}\right)}$, or *g* may conservatively be taken as 1.0.

In many resources therefore, *g* is taken as 1.0 and simply disappears from the expression for $M_{cr}$. Thus for the simple case of fork end supports and loads which are not destabilising, the familiar expression for $M_{cr}$ results:

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

Simplified expressions to determine the non-dimensional slenderness directly, without calculating $M_{cr}$, are also available. In SN002, a simplified expression is given as $\bar{\lambda}_{LT} = \frac{1}{\sqrt{C_1}} UV\bar{\lambda}_z\sqrt{\beta_w}$. Readers will recognise this as the form of the expression in BS 5950-1, Clause B.2.3 given as $\lambda_{LT} = uv\lambda\sqrt{\beta_w}$

In SN002, *U* is defined as $U = \sqrt{\frac{W_{pl,y} g}{A}}\sqrt{\frac{I_z}{I_w}}$, which includes the influence of the correction factor, *g*.

In BS 5950-1, *u* is given in B.2.3 as $u = \left(\frac{4S_x^2\gamma}{A^2 h_s^2}\right)^{0.25}$

Although *g* may not be immediately apparent, the effect is seen in the variable, $\gamma$, which is defined as $\gamma = (1 - I_y/I_x)$

## Impact of including the correction factor

For universal beams, *g* varies between 0.931 and 0.989. For universal columns, *g* varies between 0.780 and 0.829.

Of course, the lateral torsional buckling resistance moment, $M_{b,Rd,}$ does not vary directly in proportion to the correction factor *g*. The effect is illustrated in the following example.

533 × 210 × 82 UKB, and 203 UKC 46, both S355, 6 m buckling length, $C_1 = 1$.

| Calculation approach | 533 UKB | | 203 UKC | |
|---|---|---|---|---|
| | $M_{cr}$ (kNm) | $M_{b,Rd}$ (kNm) | $M_{cr}$ (kNm) | $M_{b,Rd}$ (kNm) |
| Simple approach with $UV = 0.9$ (actually, $UV = 0.775$) | | 254.8 | | 85.4 |
| Simple approach with *U* and *V* calculated, but no correction factor, *g* | | 312.4 | | 115.3 |
| Simple approach with *U* and *V* calculated, including correction factor, *g* | | 320.1 | | 125.2 |
| Calculating $M_{cr}$, but no correction factor, *g* | 369.4 | 311.8 | 152.8 | 115.4 |
| Blue Book[2] | | 312.0 | | 115.0 |
| Calculating $M_{cr}$, with correction factor, *g* | 377.5 | 316.5 | 187.9 | 126.8 |
| *LTBeam*[3] | 370.3 | | 152.9 | |

The impact of *g* varies as the slenderness changes, so the results in the table above should not be taken as representing the general situation. For the universal beam, the increase in resistance is only 1.2%. Although for the universal column section, the increase is larger (10.4%), universal columns used as beams are not often likely to have lateral torsional buckling as the critical check. The table above also indicates the conservatism in simply assuming that $UV = 0.9$.

SCI recommend that for simplicity and safety, *g* is taken as 1.0. It would be unsafe to include the effect of *g* if the beam were pre-cambered[4]. In the Blue Book, $M_{b,Rd}$ is calculated by firstly determining $M_{cr}$, and *g* is taken as 1.0.

References:
[1] NCCI: Determination of non dimensional slenderness of I and H sections, 2006 (available via www.steelbiz.org).
[2] SCI P363, Steel Building Design: Design Data updated May 2013.
[3] LTBeam (software freely downable from www.cticm.com).
[4] Kirby, P.A. and Nethercot, D.A.
Design for structural stability, Constrado Monographs, 1979.

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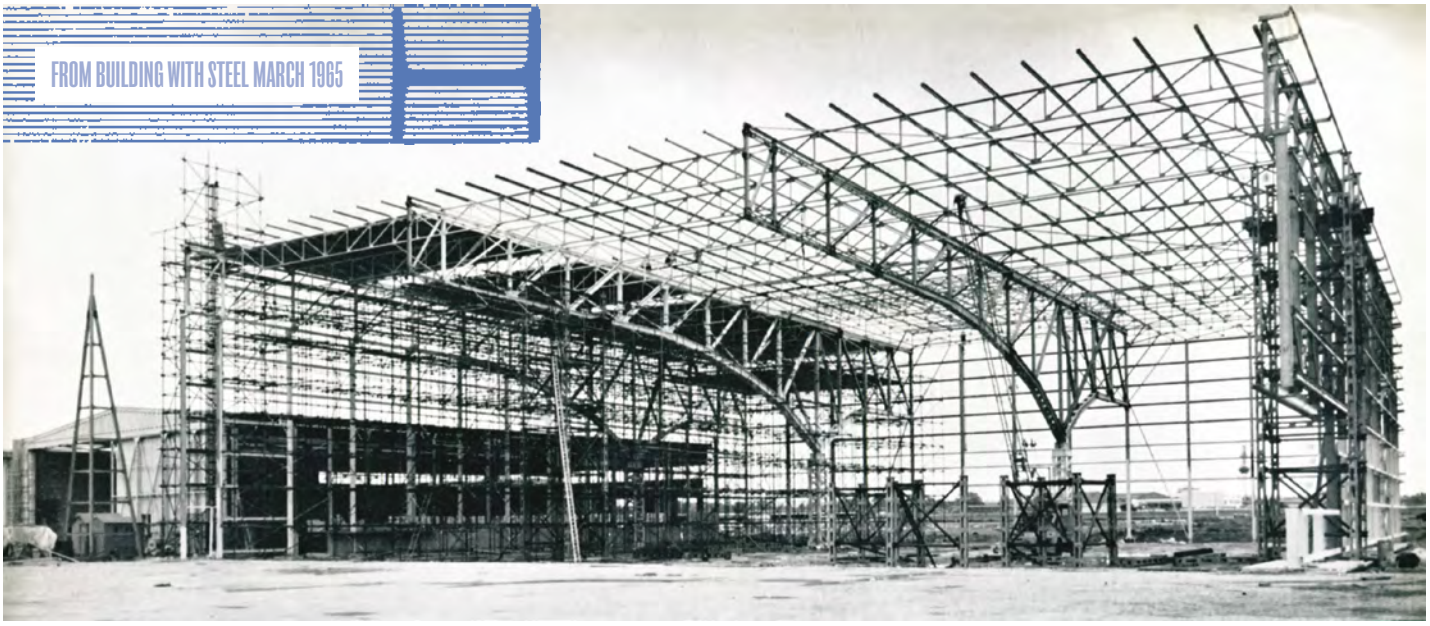
FROM BUILDING WITH STEEL MARCH 1965



# The VC10 hangar at London (Gatwick) Airport

When British United Airways purchased Vickers VC10 jets the dimensions of these machines, particularly the height of the tail, made it necessary to provide a new hangar to accommodate them for servicing purposes. It is a steel-framed building with double sandwich asbestos cladding and, as will be evident later, no other material than steel could have been employed with such success.

This hangar is unique in the fact that it is possibly the largest of its kind in the United Kingdom and perhaps in Europe. Although it has a floor area of approximately 33,000 sq. ft. only two internal columns are used and they are positioned to give minimum interference to the various types of craft likely to be parked inside. An interesting feature is the provision of a slot in one wall through which the wing of a second aircraft can project, allowing the complete fuselage to be under cover during servicing. By careful planning it has been established that the hangar can in fact house at least three machines simultaneously, e.g. a VC10 in the centre and a Britannia or BAC One-Eleven on each side.

The huge unobstructed door area is made possible by employing a design incorporating four 191-ft. long cantilever truss girders spaced at 60-ft centres and supporting secondary lattice roof trusses transversely at 15-ft centres. The VC10 enters the hangar tail first, the tail positioned between the centre stanchions, where staging along the rear wall enables the mechanics to service without difficulty the tail fin and tail plane. As the fleet increases and additional hangar space becomes necessary, unlimited lateral extension of the hangar by bays of similar construction is a relatively simple procedure.

The overhang of the cantilever girders is 134 ft. and under maximum loading conditions of wind and snow, but excluding the allowed dead weight, a maximum deflection of 6 in. at the tips of the cantilevers is expected. Allowance for this deflection has been made in the design of the side cladding and also in the housing of the top guides to the sliding hangar doors.

The connections between the cantilevers and their latticed support columns are of the conventional rocker type. The reaction from the trusses is transmitted to a system of bearing plates and beams in order to achieve an even distribution of the load over the latticed columns. Restraint to the cantilever frames is provided by tension members in the rear frame of the structure adequately anchored with heavy mass concrete isolated gravity bases. When the cantilever frames were erected and the roof sheeting fixed, the actual deflection of the cantilever tip varied from the calculated deflection by no more than half an inch.

The upper rollers of the hangar doors are specially designed so that vertical deflection of the roof over the doors can be accommodated in very shallow and lightweight top guides. This has resulted in considerable economy of structural materials in the guides and also minimised the concentrated dead loads at the extremities of the trusses. The sliding hangar doors consist of six 50-ft high by 30-ft wide manually operated leaves.

The architects for this project were Clive Pascall and Peter Watson.

## Steel framed hangars for the Middle East

During recent years the Air Ministry has placed orders for a number of large steel-framed hangars for desitinations abroad. For this type of work steelwork has several important advantages over other methods of construction, apart from those concerned with design. For instance, the structural members can be completed in this country, ready for erection, and occupy minimum cargo space when shipping them abroad. On arrival the hangars can be conveniently transported and easily erected by local semi-skilled labour.

# Steelwork contractors for buildings

Membership of BCSA is open to any Steelwork Contractor who has a fabrication facility within the United Kingdom or Republic of Ireland.
Details of BCSA membership and services can be obtained from
Gillian Mitchell MBE, Deputy Director General, BCSA, 4 Whitehall Court, London SW1A 2ES
Tel: 020 7747 8121 Email: *gillian.mitchell@steelconstruction.org*

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

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

- **FPC** Factory Production Control certification to BS EN 1090-1
  - **1** – Execution Class 1
  - **2** – Execution Class 2
  - **3** – Execution Class 3
  - **4** – Execution Class 4
- **QM** Quality management certification to ISO 9001
- **SCM** Steel Construction Sustainability Charter
  (● = Gold, ● = Silver, ● = Member)

**Notes**

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

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

| Company name | Tel | C | D | E | F | G | H | J | K | L | M | N | Q | R | S | QM | FPC | SCM | Guide Contract Value (1) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A C Bacon Engineering Ltd | 01953 850611 | | | ● | ● | | ● | | | | | | | | | | 2 | | Up to £3,000,000 |
| 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 | ● | Up to £2,000,000 |
| Adstone Construction Ltd | 01905 794561 | | | ● | ● | ● | ● | | | | | | | | | ✔ | 2 | ● | Up to £3,000,000 |
| Advanced Fabrications Poyle Ltd | 01753 653617 | | | | ● | ● | ● | ● | ● | ● | ● | | | | ● | ✔ | 2 | | Up to £800,000 |
| AJ Engineering & Construction Services Ltd | 01309 671919 | | | ● | ● | | | | | ● | ● | | | ● | ● | ✔ | 4 | | Up to £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 | ● | 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 | ● | Above £6,000,000 |
| Border Steelwork Structures Ltd | 01228 548744 | | | ● | ● | ● | ● | | | | ● | | | | ● | | 2 | | Up to £3,000,000 |
| Bourne Construction Engineering Ltd | 01202 746666 | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ✔ | 4 | ● | Above £6,000,000 |
| Briton Fabricators Ltd | 0115 963 2901 | ● | | ● | ● | ● | ● | ● | ● | ● | ● | | | ● | ● | ✔ | 4 | | Up to £3,000,000 |
| Builders Beams Ltd | 01227 863770 | | | | ● | | | | | ● | | | | ● | ● | ✔ | 2 | | Up to £1,400,000 |
| Cairnhill Structures Ltd | 01236 449393 | ● | | | ● | ● | ● | ● | ● | ● | | | | ● | ● | ✔ | 4 | ● | Up to £3,000,000 |
| Caunton Engineering Ltd | 01773 531111 | ● | ● | ● | ● | ● | ● | ● | | ● | ● | ● | | ● | ● | ✔ | 4 | ● | Up to £6,000,000 |
| Cleveland Bridge UK Ltd | 01325 381188 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | | ✔ | 4 | ● | Above £6,000,000* |
| CMF Ltd | 020 8844 0940 | | | | ● | | ● | ● | | ● | ● | | | | ● | ✔ | 4 | | Up to £6,000,000 |
| Cook Fabrications Ltd | 01303 893011 | | | | ● | | | | | ● | ● | | | ● | ● | | 2 | | Up to £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 | ● | Up to £6,000,000 |
| EvadX Ltd | 01745 336413 | | | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | ✔ | 2 | ● | 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 | ● | 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 | | | ● | ● | | ● | | ● | ● | ● | | | ● | ● | | 3 | | Up to £400,000 |
| Luxtrade Ltd | 01902 353182 | | | | | | | | | ● | ● | | | | ● | ✔ | 2 | | Up to £800,000 |
| M Hasson & Sons Ltd | 028 2957 1281 | | | ● | ● | ● | ● | ● | ● | ● | ● | | | | ● | ✔ | 4 | | Up to £2,000,000 |
| M J Patch Structures Ltd | 01275 333431 | | | | ● | | | | | ● | ● | | | ● | | ✔ | 2 | | Up to £800,000 |
| M&S Engineering Ltd | 01461 40111 | | | | ● | | | | ● | ● | ● | | | ● | ● | | 2 | | Up to £1,400,000 |
| 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 £4,000,000 |
| William Hare Ltd | 0161 609 0000 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ✔ | 4 | ● | Above £6,000,000 |
| Company name | Tel | C | D | E | F | G | H | J | K | L | M | N | Q | R | S | QM | FPC | SCM | Guide Contract Value (1) |

# Corporate Members

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

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

| 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 | |
| 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 | |

| Company name | Tel | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | CE | SCM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cellbeam Ltd | 01937 840600 | ● | | | | | | | | | M | |
| Cellshield Ltd | 01937 840600 | | | | | | | ● | | | N/A | |
| Cleveland Steel & Tubes Ltd | 01845 577789 | | | | | | | | ● | | M | |
| CMC (UK) Ltd | 029 2089 5260 | | | | | | | | ● | | D/I | |
| Composite Profiles UK Ltd | 01202 659237 | ● | | | | | | | | | D/I | |
| Cooper & Turner Ltd | 0114 256 0057 | | | | | | | | | ● | M | |
| Cutmaster Machines (UK) Ltd | 01226 707865 | | | | | ● | | | | | N/A | |
| Daver Steels Ltd | 0114 261 1999 | ● | | | | | | | | | M | |
| Duggan Profiles & Steel Service Centre Ltd | 00 353 56 7722485 | ● | | | | | | | ● | | M | |

# Steelwork contractors for bridgeworks

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

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

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

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

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

| BCSA steelwork contractor member | Tel | FG | PG | TW | BA | CM | MB | RF | AS | QM | FPC | NHSS 19A | NHSS 20 | SCM | Guide Contract Value (1) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Briton Fabricators Ltd | 0115 963 2901 | ● | ● | ● | ● | ● | ● | ● | ● | ✓ | 4 | | ✓ | | Up to £3,000,000 |
| Cairnhill Structures Ltd | 01236 449393 | ● | ● | ● | ● | | | ● | ● | ✓ | 4 | | | ● | Up to £3,000,000 |
| Cleveland Bridge UK Ltd | 01325 381188 | ● | ● | ● | ● | ● | ● | ● | ● | ✓ | 4 | ✓ | ✓ | ● | Above £6,000,000* |
| Four-Tees Engineers Ltd | 01489 885899 | ● | ● | ● | ● | | ● | ● | ● | ✓ | 3 | | ✓ | ● | Up to £2,000,000 |
| Kiernan Structural Steel Ltd | 00 353 43 334 1445 | | ● | | ● | | | ● | ● | ✓ | 4 | | ✓ | ● | Up to £3,000,000 |
| Mabey Bridge Ltd | 01291 623801 | ● | ● | ● | ● | ● | ● | ● | ● | ✓ | 4 | ✓ | ✓ | ● | 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 | | | ● | Up to £6,000,000 |
| S H Structures Ltd | 01977 681931 | ● | | ● | ● | ● | ● | | ● | ✓ | 4 | | ✓ | ● | Up to £3,000,000 |
| Severfield (UK) Ltd | 01204 699999 | ● | ● | ● | ● | ● | ● | ● | ● | ✓ | 4 | | ✓ | ● | Above £6,000,000 |
| **Non-BCSA member** | | | | | | | | | | | | | | | |
| A+J Fabtech Ltd | 01924 439614 | ● | ● | | ● | | | | ● | ✓ | 4 | | | | Up to £400,000 |
| Allerton Steel Ltd | 01609 774471 | ● | ● | ● | ● | | | | ● | ✓ | 4 | | ✓ | | Up to £4,000,000 |
| Centregreat Engineering Ltd | 029 2046 5683 | ● | ● | ● | ● | | ● | ● | ● | ✓ | 4 | | | | Up to £400,000 |
| Cimolai SpA | 01223 350876 | ● | ● | ● | ● | ● | ● | ● | ● | ✓ | 4 | | | | Above £6,000,000 |
| Concrete & Timber Services Ltd | 01484 606416 | ● | ● | ● | ● | ● | ● | | ● | ✓ | 4 | | | ● | Up to £800,000 |
| Donyal Engineering Ltd | 01207 270909 | ● | | | | | | ● | ● | ✓ | 3 | | ✓ | ● | Up to £1,400,000 |
| Francis & Lewis International Ltd | 01452 722200 | | | | | | | ● | ● | ✓ | 2 | | ✓ | ● | Up to £2,000,000 |
| Harland & Wolff Heavy Industries Ltd | 028 9045 8456 | ● | ● | ● | ● | ● | | ● | ● | ✓ | 3 | | | | Up to £2,000,000 |
| IHC Engineering (UK) Ltd | 01773 861734 | ● | | | | | | | ● | ✓ | 3 | | ✓ | | Up to £400,000 |
| Interserve Construction Ltd | 0121 344 4888 | | | | | | | ● | ● | ✓ | 3 | | | | Above £6,000,000* |
| Interserve Construction Ltd | 020 8311 5500 | ● | ● | ● | ● | | ● | ● | ● | ✓ | 3 | | | | Above £6,000,000* |
| Lanarkshire Welding Company Ltd | 01698 264271 | ● | ● | ● | ● | ● | ● | ● | ● | ✓ | 4 | ✓ | | ● | Up to £2,000,000 |
| P C Richardson & Co (Middlesbrough) Ltd | 01642 714791 | ● | | | | | | ● | ● | ✓ | N/A | | | | Up to £3,000,000 |
| Victor Buyck Steel Construction | 00 32 9 376 2211 | ● | ● | ● | ● | ● | ● | ● | ● | ✓ | 4 | | | | Above £6,000,000 |

| Company name | Tel | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | CE | SCM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| easi-edge Ltd | 01777 870901 | | | | | | | ● | | | N/A | ● |
| Fabsec Ltd | 0845 094 2530 | ● | | | | | | | | | N/A | |
| FabTrol Systems UK Ltd | 01274 590865 | | ● | | | | | | | | N/A | |
| Ficep (UK) Ltd | 01942 223530 | | | | | ● | | | | | N/A | |
| FLI Structures | 01452 722200 | ● | | | | | | | | | M | ● |
| Forward Protective Coatings Ltd | 01623 748323 | | | | | | ● | | | | N/A | |
| Goodwin Steel Castings Ltd | 01782 220000 | ● | | | | | | | | | N/A | |
| Graitec UK Ltd | 0844 543 8888 | | ● | | | | | | | | N/A | |
| Hadley Group Ltd | 0121 555 1342 | ● | | | | | | | | | M | ○ |
| Hempel UK Ltd | 01633 874024 | | | | | | ● | | | | N/A | |
| Highland Metals Ltd | 01343 548855 | | | | | | ● | | | | N/A | |
| Hilti (GB) Ltd | 0800 886100 | | | | | | | | | ● | M | |
| Hi-Span Ltd | 01953 603081 | ● | | | | | | | | | M | ○ |
| International Paint Ltd | 0191 469 6111 | | | | | | ● | | | | N/A | ● |
| Jack Tighe Ltd | 01302 880360 | | | | | | ● | | | | N/A | |
| Jamestown Cladding & Profiling Ltd | 00 353 45 434288 | ● | | | | | | | | | M | |
| John Parker & Sons Ltd | 01227 783200 | | | | | | | | ● | ● | D/I | |
| Joseph Ash Galvanizing | 01246 854650 | | | | | | ● | | | | N/A | |
| Jotun Paints (Europe) Ltd | 01724 400000 | | | | | | ● | | | | N/A | |
| Kaltenbach Ltd | 01234 213201 | | | | | ● | | | | | N/A | |
| Kingspan Structural Products | 01944 712000 | ● | | | | | | | | | M | ● |
| Lindapter International | 01274 521444 | | | | | | | | | ● | M | |

| 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 Updates April 2015**

## BS EN PUBLICATIONS

**BS EN 14399-1:2015**
High-strength structural bolting assemblies for preloading. General requirements
*Supersedes BS EN 14399-1:2005*

**BS EN 14399-2:2015**
High-strength structural bolting assemblies for preloading. Suitability for preloading
*Supersedes BS EN 14399-2:2005*

**BS EN 14399-3:2015**
High-strength structural bolting assemblies for preloading. System HR. Hexagon bolt and nut assemblies
*Supersedes BS EN 14399-3:2005*

**BS EN 14399-4:2015**
High-strength structural bolting assemblies for preloading. System HV. Hexagon bolt and nut assemblies
*Supersedes BS EN 14399-4:2005*

**BS EN 14399-5:2015**
High-strength structural bolting assemblies for preloading. Plain washers
*Supersedes BS EN 14399-5:2005*

**BS EN 14399-6:2015**
High-strength structural bolting assemblies for preloading. Plain chamfered washers
*Supersedes BS EN 14399-6:2005*

**BS EN ISO 23278:2015**
Non-destructive testing of welds. Magnetic particle testing. Acceptance levels
*Supersedes BS EN ISO 23278:2009*

## DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT – ADOPTIONS

**15/30250137 DC**
*BS EN ISO 8502-9* Preparation of steel substrates before application of paints and related products. Tests for the assessment of surface cleanliness. Field method for the conductometric determination of water-soluble salts

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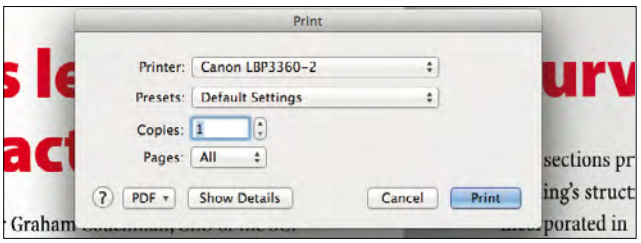


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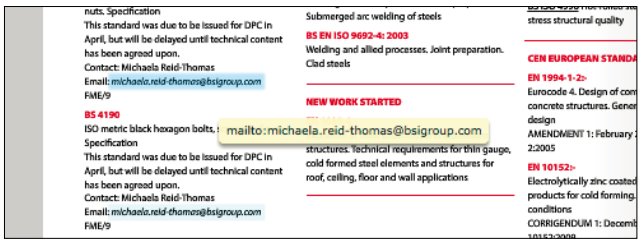


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