APRIL 2010 VOL 18 NO 4

NSC

NEW STEEL CONSTRUCTION

www.new-steel-construction.com

Gatwick interchange
Steel tops terminus
West Burton turbine halls
Excellence at Bletchley

BCSA

Organised by
The British Constructional
Steelwork Association

Steel Bridges Conference

To be held on Tuesday 13th April 2010 at the Institute of Directors, 116 Pall Mall, London, SW1

The objective of the Steel Bridges Conference is to highlight the latest developments in the design and construction of steel bridges.

The Conference is aimed at designers, main contractors and steelwork contractors.

The topics to be covered in the conference include:

- Client views of the road and rail sectors
- New Eurocode design guidance
- Highways Agency Sector Schemes
- New standard railway bridge designs
- Measuring sustainability
- Project case studies

The case studies will cover a range of current major bridge projects, each illustrating various aspects of design and construction.

All delegates will receive copies of the latest Eurocode design guidance for steel bridges due to be published in March including:

- BCSA - "Steel Bridges"
- SCI - "Composite Highway Bridges: Design to the Eurocodes"
- Corus – "Steel Bridges – Material Matters"

Delegates will also receive an electronic copy of a new set of preliminary steel bridge design charts to the Eurocodes, and an associated spreadsheet tool.

The Conference will commence at 1400 hrs in the Nash Room, and conclude with a buffet supper at 1800 hrs in the Waterloo Room.

The Conference fee is £95 plus VAT (£111.63) per person. This includes all documentation, refreshments and supper.

For further information and Booking Forms contact:

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These and other steelwork articles can be downloaded from the New Steel Construction website at www.new-steel-construction.com

Cover Image
Gatwick Airport North Terminal Interchange
Main Client: Gatwick Airport
Architect: Capita Symonds
Steelwork contractor: Bourne Steel
Steel tonnage: 800t

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Members BCSA Telephone BCSA on 020 7839 8566
Members SCI Telephone SCI on 01344 636525

 ISSN 0968-0098

Prospects from energy

The UK economy is clearly still struggling, but the debate is now centred on how strong the recovery is likely to be. At least recovery seems to have started, and longer term the fundamentals look more favourable for steel construction than a year ago. But whatever the level of total demand for construction in the next decade or so, it looks like there will be changes in its composition. The spread of types of project featured in this issue of NSC suggests something of the wide diversity of future sources of demand. Encouragingly, steel construction has a central role to play in all of them.

This month's NSC has articles on leisure centres achieving the highest sustainability commendations. A redevelopment project in London shows steel construction taking place around a busy commuter station without affecting normal operations. Another transport project of national significance is improving access within Gatwick Airport. Regeneration of Woolwich town centre has a multi storey steel-framed civic centre at its heart. The reputation of the UK steel construction industry will be enhanced by the latest Antony Gormley masterpiece which is currently being built in Scotland. All of these sources of work have growth potential.

There might be less work in some sectors in future, in education for example, but other market sectors will strengthen. A prime example of a growing market where steel will make a crucial contribution is power generation, as was heard at a recent BCSA seminar (see News). The story of lack of investment in energy is a familiar enough one for other types of infrastructure, but decisions have been made to build ten nuclear power stations in the UK over the next 15 years.

Some 80% of the cost of a nuclear power station goes on traditional construction activities rather than nuclear plant. A typical nuclear power station will need some 7,000t of steel for its turbine hall alone.

There is also a growing market for other energy related projects such as the power station near Retford, which can also be read about in this issue (p24). The future demand from energy will be huge and depends crucially on steel. There is a potential £100,000 million investment in renewable energy, much of it to be invested in offshore energy which could mean demand for some six million tonnes of steel over the next ten years.

Add on energy from waste plants, structures to house activities like anaerobic digestion plants and wave and tidal technologies and there is a huge demand coming which will in turn place demands on steel construction materials and skills.

Nick Barrett - Editor

Eurocode version of Blue Book published

The BCSA, Corus, and SCI have published a UK Eurocode version of the *'Steel Building Design: Design Data'* publication, which is also known as The Blue Book.

The new publication presents design data that has been derived in accordance with *BS EN 1993-1-1: 2005: Design of steel structures. Part 1-1: General rules and rules for buildings, BS EN 1993-1-5: Design of steel structures. Part 1-5: Plated structural elements and BS EN 1993-1-8: 2005: Design of steel structures. Part 1-8: Design of joints* using the partial factors for resistance and other national determined parameters given in the appropriate UK National Annexes.

Section properties and resistances for the following sections are given in the publication:

- Universal beams, universal columns, joists, bearing piles, parallel flange channels and structural tees cut from universal beams and universal columns to BS 4-1
- Advance Sections from Corus
- Section properties for ASB (Asymmetric Slimflor Beams) produced by Corus
- Equal and unequal angles to BS EN 10056-1
- Hot finished structural hollow sections to BS EN 10210-2 including Celsius
- Hot finished elliptical hollow sections to BS EN 10210-2
- Cold formed structural hollow sections to BS EN 10219-2 including Hybox

Copies of the publication can be purchased from the BCSA and SCI at £80 to non-members and £60 to members.

Expansion announced on Westfield Stratford City

Westfield has announced an expansion to its Stratford City shopping centre project which will see a further seven floors of office accommodation added to one of the blocks, increasing the job's overall structural steelwork tonnage to approximately 45,000t.

"A number of elements have been future proofed so that extra floors can be added," said Westfield Construction Director Keith Whitmore. "That's one of the advantages of designing with steel, it's flexible."

Situated adjacent to the London 2012 Olympic Park, Westfield Stratford City will offer 176,000m^2 of retail and leisure space, as well as office accommodation, and will be the largest urban shopping centre in Europe.

Anchored by a 22,296m^2 John Lewis department store, a 2,972m^2 Waitrose supermarket and a 18,580m^2 Marks & Spencer, the shopping centre will also be the gateway to the Olympic Park for visitors exiting Stratford Station.

Westfield Stratford City is scheduled to open in 2011, more than a year before the Olympic Games begin.

Upgrade for historic tramway

Structural steelwork is playing an integral role in the upgrade of Blackpool's tramway, which runs 11 miles along the famous seafront.

Caunton Engineering, working on behalf of main contractor Volker Fitzpatrick, is constructing a depot to house new rolling stock. The steel framed building will be able to house 20 new Supertrams.

Internally the building is divided into three parts, a maintenance area and a stabling yard, separated by an office block. Covering these zones, the structure features a curving roof with an overall span of 66m and designed to resemble waves.

To accommodate the wave-like design the roof has 12m wide alternating concave and convex sectors at differeing levels, with both rising to a slightly higher western (seafront) elevation.

The vertical space created where the high level roof meets the low level will be clad with glazing on the north side, and sheeting on the south facing side.

Caunton's Project Designer, Julian Harrold said: "The design of the portal on the glazed interface was critical as there were some very tight deflection restrictions to prevent the glass cracking."

The depot, which will eventually require 400t of structural steelwork, is scheduled to be ready for Easter 2012 when the tramway will reopen.

Olympic stadium reaches full height

The centrepiece structure for London 2012, the Olympic Stadium, has reached its full height of 60m above the field of play after the venue's steel lighting towers were lifted into place.

A 650t capacity crane was assembled in the middle of the stadium to the lift the 28m-high lighting towers on top of the inner ring of the cable net roof.

The towers, which will illuminate the action on the field of play and are necessary for high definition footage, are located high above the stadium to ensure optimum lighting angles which avoid dazzling spectators, photographers and competitors.

A total of 14 lighting towers, each weighing 34t and designed with integrated walkways, access, power supplies and cabling, have been installed.

Steelwork contractor for the project is Watson Steel Structures.

Olympic Delivery Authority Chairman John Armitt said: "The Olympic Stadium will be at the heart of the action in 2012 and its image will be beamed to billions of people across the world. The team has made impressive progress over the last year and we are on schedule to finish by the summer of 2011 to give a year for test events."

Central bridge takes shape

The initial sections of the Central Park footbridge, which spans the River Lea between the Olympic Stadium and the Aquatics Centre, and features both permanent and temporary elements, have been lifted into place.

The structure's legacy structure features two footbridges linked by a central blade-like walkway, creating a 'Z' shape. During the Games a temporary deck will be placed between the permanent spans to increase the width to allow it to carry increased spectator numbers.

The first structural steel elements of the bridge to be erected consist of a 8m wide southern span weighing 50t and a 6m wide northern span weighing around 45t.

Work is being undertaken by Lagan Construction in conjunction with steelwork contractor Watson Steel Structures.

Riser pod to arrest building site falls

Lowe Engineering said it is set to make a significant contribution to improving site safety with an innovative flooring solution developed to prevent workers falling down riser shafts.

The company has launched its Lowe Riser Pod (circled in picture), a pre-manufactured solution that provides a covering which closes up the openings inside service shafts in multi-storey buildings.

The pods consist of a series of moveable steel cross beams overlaid by chequer plates. During the construction phase, the pod acts as a part of the floor, then, when it is time to install the services, the chequer plates are removed and the services fed through the voids.

Ken Ward-Salt, Senior Projects Manager at Lowe Engineering, said: "The current methods contractors use to safeguard personnel working around riser shafts are very unsatisfactory when you consider the risks involved.

"The Lowe Riser Pod represents a huge step forward, because it solves so many problems in one go."

AROUND THE PRESS

Building Magazine
26 February 2010
The two-year rush hour
(Park Plaza Hotel) The answer is a huge truss that spans the width of the atrium from the second floor up to level 13. A Vierendeel truss was used as this has steel members set at 90 degrees, thereby allowing windows to be inserted. Each truss sits on two columns 32m apart on either side of the ballroom.

Construction News
11 March 2010
Past meets future in station upgrade
But a value engineering exercise alongside the client's engineer saw that plan altered to the steel pile design that the Nuttall John Martin team is installing.

The Structural Engineer
16 February 2010
Unilever's flying carpets
The geometrically complex 'flying carpets' hang in the central atrium, supported by duplex stainless steel rods that are engineered to withstand local fires. Innovative connection details were developed, with multidirectional adjustment capability. Vibration due to pedestrian activity was analysed, and an unusual central staircase arrangement ensured that the design achieves office quality responses on the floors.

New Civil Engineer
11 March 2010
Formula one fun
A central ring of columns around this funnel supports the main roof and these extend up and outwards as beams to the edge of the central section to form the main radial lines of support. They are supported at the outer edges on V-shaped columns and also halfway between the V columns and central columns by another line of columns that keep structural spans to around 75m.

British Standards to remain in place in Scotland

British Standards, such as BS 5950, can continue to be used in Scotland after 31 March 2010.

Following a meeting between the BCSA President Jack Sanderson and Professor Russel Griggs Chairman of the Regulatory Standard Division, it has been agreed that a list of both the Eurocodes and the soon to be withdrawn British Standards will be included in the guidance issued by Building Standards in Scotland.

"The Scottish Technical Handbooks will be amended to reflect this change," said Dr David Moore, BCSA Director of Engineering.

BSI withdrew all British Standards last month that conflict with the Eurocodes. BCSA members are reminded that the Building Regulations in England, Wales and Scotland are expressed in functional terms and do not dictate the national design standard that should be used.

A BSI committee responsible for BS 5950 - structural use of steelwork in building - has confirmed that it is safe to use this standard until at least 2014/15.

New bandsaw maximises cutting performance

Kaltenbach said its recently launched Behringer HBM400 SC (speed cutting) machine features revolutionary bandsawing technology and takes cutting performance to new levels.

The company said the HBM400 has cutting speeds up to seven times faster than conventional bandsaws, achieving high performance and precision straight cutting of all solid metals, up to 400mm diameter or 400 x 400 in section.

The HBM400 utilises a specially developed, thinner bandsaw blade which is 1.1mm thick. This is said to reduce the cutting force per tooth and achieves a much narrower kerf of only 1.7mm.

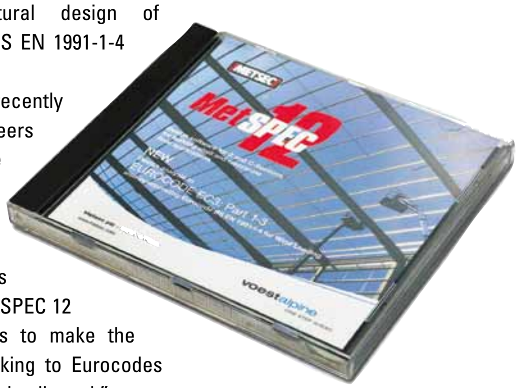
Controlled from an ergonomic and user friendly console, the HBM400 is said to be simple to operate. Fully enclosed and using a proven vibration free structure, the sound attenuating design is said to achieve quiet operation even under extreme high speed work.

Software includes Eurocode design

Cold rolled steel specialist Metsec has launched the latest version of its building shell design software MetSPEC 12, with enhanced features including design analysis to Structural Eurocode EC: Part 1.3.

Roy Burns, Divisional Managing Director of Metsec's Lightweight Structural Systems, said: "We know that the switch to harmonised European standards for construction is presenting a huge challenge to the steel construction industry. Our aim is to help engineers get used to the new requirements and method of working in relation to wind loading for the structural design of calculations to BS EN 1991-1-4 and BS 6399-2.

"It was recently stated that engineers need more Eurocode compliant software, of the kind Metsec is offering with MetSPEC 12 if the industry is to make the transition to working to Eurocodes within the timescale allowed."



Power generation will provide boost to steel construction industry

Energy from waste facilities require steel frames for the majority of their buildings

A recent BCSA hosted seminar on nuclear and renewable power generation projects stressed the importance of these markets to the steel construction industry.

The seminar was chaired by BCSA President Jack Sanderson and was made possible by the assistance of the Department for Business, Innovation and Skills; Department for Energy and Climate Change (DECC), and the Nuclear Industry Association (NIA).

The seminar was told that in 2008 the NIA produced a report for the Government outlining that approximately 80% of nuclear new build is not nuclear, but is similar to other major construction projects.

This means steel packages are part of the civil works and include an estimated 15,000t of steelwork for each of the 10 new proposed nuclear plants. The containment vessels are substantial steel structures made from 44mm plate, with a total weight of 3,500t, and made up of modules of up to 900t each.

The Government Department of Energy and Climate Change (DECC) has set targets to achieve a 34% cut in greenhouse gas emissions by 2020. The UK will also cut emissions by 80% by 2050.

Meeting the UK renewables target will need a capital investment of approximately £100bn, with a substantial part of the target to be met with offshore wind. Approximately 22GW of power is needed by 2020 to meet UK EU commitments and this could create 80,000 new jobs. Each offshore wind turbine could include up to 250t of steelwork with the jacket and foundations containing a further 750t. This equates to 6 million tonnes of steel to be used by 2020 which could be worth £20bn to the industry.

Delegates at the seminar were also told that other energy providers could also require significant structural steelwork, such as energy from waste, which could require 100,000t of steel over a six year period.

DEFRA has an aspiration for 1,000 anaerobic digestion farms with each containing about 500t of steel which could result in 220,000t of steel being used by 2020. Wave and tidal technologies are still emerging and could result in significant infrastructure projects.

Go ahead given for wind turbine facility

Mabey Bridge has been given the green light by Monmouthshire Council to expand its new facility which will see it become the largest UK manufacturer of wind turbine towers, both for onshore and offshore applications.

The company purchased the site in Chepstow in January for £13M, and it will now invest a further £25M increasing the size of the warehouse to enable the fabrication of wind turbine towers. Once the work is complete Mabey expects to fabricate around 300 towers per annum.

Peter Lloyd, Mabey Bridge Managing Director, said: "Now we have planning approval we are able to start construction on the necessary extension to the existing building that will be required to apply protective coatings to these towers.

"The new facility will be a state-of-the-art factory for tower manufacturing, allowing us to compete with any other tower manufacturers worldwide."

NEWS IN BRIEF

AceCad Software has released a new collaborative 3D project review tool known as Struwalker. It enables effective communication and model sharing between architects, engineers, detailers, fabricators and construction teams. It is said to provide a highly effective 3D visualisation tool for displaying and interacting with structural models and associated data, from major steel detailing and drafting systems such as StruCad.

Marion Rich, **BCSA** Director of Legal and Contractual Affairs, said: "Amendments to the 'Construction Act' were passed through Parliament last November as Part 8 of the Local Democracy, Economic Development and Construction Act 2009. The amendments cannot however be brought into effect until the Scheme for Construction Contracts has been amended and the Department for Business, Innovation and Skills is currently preparing an updated Scheme which will go out to consultation in the Spring."

Studwelders won the Steelwork prize at the Specialists Awards, held recently at the Hilton Hotel, London. The awards are supported by the National Specialist Contractors Council and its Chief Executive Suzannah Nichol, said: "Without you we would have no schools, hospitals, offices, universities, houses."

Barrett Steel Buildings has been awarded the Sustainability Award for 2009 by its regular client Willmott Dixon Construction. During the annual supply chain event held by the contractor, Barrett was also nominated for, but narrowly missed out on, the award of Sub-Contractor of the Year.

The **BSI** has published an amendment to BS 5950 Part 3.1: 2010 Structural use of steelwork in building - Part 3: Design in composite construction - Section 3.1 Code of practice for design of simple and continuous composite beams. The purpose is to update the recommendations on shear studs, and the standard came into effect on 31 March 2010.

Repeat CE Marking of upgraded steel sections not permitted

Sector Group 17, the European Notified Body, recently discussed the CE Marking of steel sections and concluded that, while re-testing of sections to verify the properties of the actual material is permitted, repeat CE Marking is not allowed under the harmonised standard for the manufacture of steel, BS EN 10025-1.

The Group did recognise that re-testing to verify properties and possibly to upgrade the material may be contractually necessary. The procedure for upgrading should be similar to that used for a Type 3.2 Specific Inspection Certificate in that the purchaser would be involved in the testing.

The tests would need to be undertaken as follows:

- By a test house with accreditation to ISO/IEC 17025 that is specific for the type of tests being carried out:
- In accordance with the test methods and procedures given in BS EN 10025-1
- The test reports issued should be in the form of specific inspection certificates in accordance with BS EN 10204.

Steel fixings complete architectural vision

Lindapter's new Hollo-Bolt Flush Fit was specified as the steelwork connection in HafenCity's Brooktorkai quarter in Hamburg, securing a wide spanning glass roof and a multi storey windowed elevation without the fixings being visible.

The Hollo-Bolt Flush Fit was used to construct the glazing support frame with a connection design that included splice joints inside the adjoining pre-drilled SHS sections, allowing the fixings to be simply inserted and tightened with a torque wrench for a rapid installation.

This solution required no specialist equipment or labour and reduced the amount of working from height. Lindapter said the resulting steelwork is not only structurally sound, but aesthetically pleasing, presenting a clean symmetrical appearance.

Galvanised steelwork for Himalayan zoo centre

Much of the steelwork used to create the £7M Himalaya visitor centre at Twycross Zoo was galvanised by East Anglian Galvanizing, which is part of the Wedge Galvanizing Group.

The eco-friendly centre (NSC January 2010) features a snow leopard enclosure and wetland sanctuary for wader birds, as well as a 300-seater restaurant, retail space and conference rooms.

East Anglian Galvanizing successfully galvanised steelwork - including external guy cables - on behalf of the steelwork contractor Adey Steel.

Selwyn Parrish, Sales and Commercial Manager at East Anglian Galvanizing, said: "We are delighted to have been asked to galvanise steel for this leading facility which will put Twycross in the very top tier of British zoos.

"We are especially pleased that the new structure has been designed for sustainability and we believe that galvanising has an important role to play, by providing long-lasting, maintenance free protection for up to 60 years and by the full recyclability of the zinc coating."

Diary

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

13 April 2010
Steel Connection Design
Glasgow

13 April 2010
Steel Bridges Conference
Half day conference, pm
Institute of Directors, London

20 April 2010
Portal Frame Design
Coventry

22 April 2010
Composite Design to EC4
Birmingham

27 April 2010
Steel Building Design to EC3
Newcastle

29 April 2010
Floor Vibrations
Oxford

5 & 6 May 2010
Essential Steelwork Design
Bristol

12 May 2010
Preparation for Eurocodes
ISE, London

18 May 2010
Portal Frame Design
Edinburgh

27 May 2010
Stability of Steel Framed Buildings
Reading

FACT FILE
Gatwick Airport North Terminal Interchange
Client: *Gatwick Airport*
Architect: *Capita Symonds*
Main contractor: *Costain*
Structural engineer: *WSP*
Steelwork contractor: *Bourne Steel*
Steel tonnage: *800t*
Project value: *£20M*

New interchange checks in at airport

To accommodate an increasing volume of passengers at Gatwick, the UK's second busiest airport, a development programme is in full swing which includes a new North Terminal Interchange.

Passengers using Gatwick Airport's North Terminal will soon be able to benefit from a new interchange facility which will allow easier and better access to and from the Inter Terminal Transit System (ITTS) station (the train that shuttles between Gatwick's two terminals), short stay car parks and Sofitel Hotel.

Forming part of Gatwick's North Terminal Landside Development Programme, the £20M North Terminal Interchange (NTI) project commenced early last year and is scheduled to be completed this Spring.

Measuring 100m long by 60m wide, the new interchange will be housed in a 20.5m high steel framed structure which will provide a light, airy, low maintenance space for the airport's passengers.

The new structure has three levels, ground floor offering access into the arrivals hall; first floor serving the new ITTS station and the hotel; and second floor serving the terminal's departures lounge. All floors will have access to the existing short stay park as well as a second multi-storey car park which will be constructed adjacent to the NTI on a site currently occupied by the project team's cabins.

Construction of the new station for the NTI required the demolition of the existing station structure then building a replacement around the existing tracks. The works immediately adjacent to the tracks were undertaken within a five-month possession of the rail infrastructure.

Work includes the installation of 250 piles, 65 pile caps, 800t of structural steelwork, a vertical transportation system plus associated mechanical,

Above: The main structure is a portal frame design with three main spans of 20m

Above: The three level interchange is housed beneath a stepped roof covered with ETFE

electrical and building management systems. Features within the new interchange will include two 75m long travelators, two escalators and 10 new lifts.

All steelwork and concrete floors for the project are being undertaken by Bourne Steel and it has been on site since September. One of its initial tasks was to erect new enclosures for the ITTS at the North Terminal railhead. The steel framed enclosures, which will house the platform's separate boarding and exiting doors, are positioned to sit above and either side of the two existing tracks which in turn are supported on a concrete runway.

Each of the two enclosures measures 57.6m long by 3.75m wide and 3.85m high. In order to speed up the erection and not impinge on the site's other steelwork elements, the enclosures were brought to site in fully assembled modules, eight in total, measuring 14.4m long.

The modules were made from a series of 200 x 100 x 6 RHS 'goal post' frames, tied at the top with 200 x 200 x 6.3 SHS sections and fully welded to accommodate bomb blast loads.

"Bringing the fully assembled modules to site allowed us to erect all eight in just two days," says Bourne Steel Senior Project Manager Guy Shepherd. "Because of the speed of erection it also meant we didn't interfere with the main frame's roof erection which was already underway."

Using a 160t mobile crane to lift the 8t modules into place, Bourne had also installed additional steel bracing to the enclosures. Consisting of strengthening 203 beams and CHS bracing, this steelwork kept the modules rigid during transportation to site and for the duration of the erection process. Once each module was in place, all temporary steel was removed.

Below: Fully assembled modules were brought to site for the train enclosures

"Bringing the fully assembled modules to site allowed us to erect all eight in just two days,"

In order to make space for a large column free area around the enclosures and the adjacent platforms a large 22m long bowstring truss straddles the ITTS zone. This large truss, which was brought to site in two pieces, also partially carries the upper (second) floor slab.

The main frame for the NTI is attached to the North Terminal along the western elevation and is formed by a series of 508 x 16 CHS columns. These columns will all be left exposed, along with their connections, as they provide a feature element to the project.

The main steelwork structure is portal frame design with three spans of 20m. The two outer bays have a sloping roof member, while the middle bay has a curved beam, giving the roof its desired camber.

"The 20m long beams were brought to site in one piece, which isn't particularly long, but they're reaching the maximum length we could transport into the airport site," comments Mr Shepherd.

Steel braced lift shafts are positioned on either side of the NTI and provide the overall structure with its stability. Offering access to the short stay car parks the lift shafts were the first to be erected, with the two floors and their supporting columns then erected between them. Finally the steel framed roof was erected which has since been covered with 3,000m^2 of inflated ETFE.

Although it will have rain screens and wind protection, plus shelter from existing buildings such as the adjacent multi-storey car park, the new NTI will essentially be an open-sided structure. To allow the later installation of the fabric wind screens, Bourne has installed a series of lugs around the perimeter steelwork which the screens will be tied to.

In terms of complexities, the proximity of other operational airport facilities is a significant engineering challenge," sums up Brendan Conlon, Costain Project Director.

"At the east side there is the airport hotel and we are literally digging up their front doorstep and reconstructing their hotel reception area. To the south, the new structural steelwork is just 300mm away from the existing multi-storey car park. Immediately to the west is the existing road and passenger drop-off and pick-up point. To the north are temporary buildings for airport engineering and maintenance staff. The only barrier between us and the public and airport operations is the site perimeter hoarding."

The completion of the NTI is scheduled for May 2010.

On track at City of London station

FACT FILE
Cannon Street Station redevelopment, London
Main Client: Network Rail
Developer: Hines UK
Architect: Foggo Associates
Main contractor: Laing O'Rourke
Structural engineer: Foggo Associates
Steelwork contractor: Watson Steel Structures
Steel tonnage: 7,500t

An eight storey office block being built above Cannon Street Station is set to usher in a new and brighter era for the busy terminus. Martin Cooper reports.

Cannon Street Station is one of London's busiest rail terminuses and among the top ten busiest in the country, serving some 95,000 City workers each day. As well as passengers arriving from or departing to Kent and Sussex, Cannon Street is also a major underground station and consequently rush-hour congestion is not uncommon.

Improvement to the station is sorely needed and work is currently continuing apace to construct an eight-storey 37,000m^2 office building above a new railway concourse and tube station entrance.

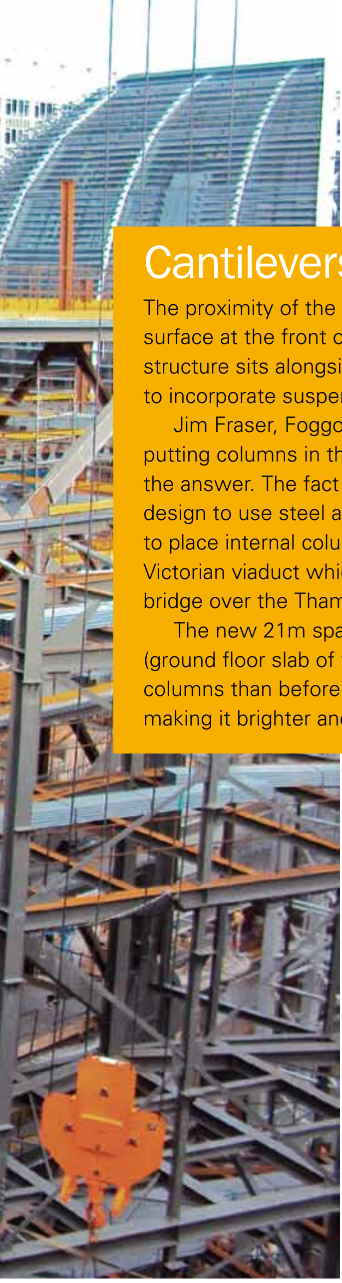
Right: Steel erection has progressed without the need to close the busy station

Network Rail and project developer Hines UK says the development will transform the station, making it brighter, easier to use, and more spacious and open, while the new architecturally striking building above will bring presence to the site.

As with most construction projects in the City of London, the job has had to cope with limited space, busy surrounding streets and uniquely, a functioning railway station in the midst of the site.

"This is one of the main challenges associated with the project," says Giles Fazan, Hines Construction Director. "We are improving the station and building new offices above while keeping everything open to commuters. We've achieved this by doing much of the work during nighttime and weekend possessions."

The new station roof has been described as resembling a giant table as it is supported by four large 17m long steel columns which have been threaded through the station platforms.



Cantilevers and big spans

The proximity of the Circle and District Lines' underground tunnels to the surface at the front of the building and the fact that the south side of the structure sits alongside a scheduled ancient monument, meant the design had to incorporate suspended or cantilevering north and south elevations.

Jim Fraser, Foggo Associates Project Engineer, says: "We needed to avoid putting columns in these areas and minimise digging, so large cantilevers were the answer. The fact that we are building over a 'live', station also drove the design to use steel and dictated where we could place columns. We've had to place internal columns through platforms, and either side of the original Victorian viaduct which carries the railway lines out of the station and onto the bridge over the Thames."

The new 21m spans in the station, which have been created by the 'deck' (ground floor slab of the new building and station roof) mean there are also less columns than before. This has successfully opened up the station's concourse making it brighter and more passenger friendly.

Above: The central section of the new structure sits above the station concourse

Below: Sequence of erection for the two cantilevers which will involve strand jacks being attached to the bottom booms. The jacks will remain in place until steelwork is completed

Before work could start on the new structure an existing 15-storey office block situated above the station had to be demolished. This was successfully achieved above the 'live' railway station using three tower cranes which had to utilise shielding and netting to avoid slewing over the adjacent roads, as the demolition process took-in the entire project's footprint. The old structure was dismantled down to its first floor slab, which was also the station's roof.

"We then had to programme the next stage to suit the best way of keeping the station functioning normally," explains Andrew Veness, Laing O'Rourke Project Director. "A new deck was installed beneath the old one, with a 1.5m clearance, and once it was completed we then demolished the old deck above, using the new concrete slab as a crash deck."

The new deck was installed during nighttime shifts to avoid any passenger disruption, using a series of 21m long Fabsec cellular beams.

This new station roof or deck has been described as resembling a giant table as it is supported by four large 17m long steel columns which have been threaded through the station platforms. Weighing 17t each, these large members are made from plated box girders and were brought to site as single pieces. The tabletop, which supports the central part of the new structure, is also supported by four steel braced cores, located in each corner.

"We needed a lightweight solution and that's why we chose steel for the framing material," explains Mr Veness. "The cores are also steel because we again needed a lighter solution as they are founded on old foundations and we had to limit the loads."

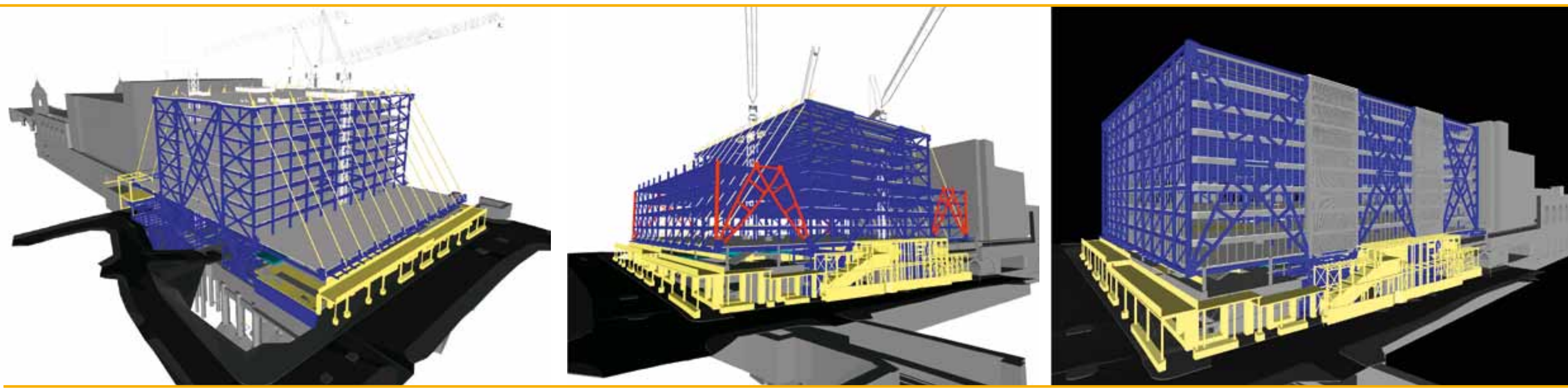
The steel cores punch through the station platforms, avoiding the underground railway tunnels. Inside each of the cores at ground level there is a large 14m high steel structure, dubbed an hourglass. Each weighing 100t and assembled from six individual steel girders, the hourglasses help stabilise the deck and structure above by absorbing the loads and distributing them evenly throughout the foundations.

The tabletop deck, which measures 67.5m along its north and south elevations, supports the majority of the steelwork for the new structure. Steelwork can be divided into three sectors consisting of 12m, 21m and 12m spans in the east to west direction, sitting directly on the tabletop deck. There are then two further sectors with 21m spans over the north and south elevations which cantilever off of the deck. The grids do not alter for the entire structure's floorplan and offer the building large column free office space.

The steel erection, being undertaken by Watson Steel Structures, initially involved erecting the central area of the building (above the tabletop) up to the topmost eighth level.

Once this was completed, the two 21m wide x 67.5m long cantilevers will be erected to the north and south elevations.

These two cantilevers are substantial by any



Top: Impression of completed structure showing an X-frame positioned on the cantilever
Above: Minimal temporary works are in place at the station entrance
Below: An hourglass structure is positioned inside each core to help stabilise the new building

reckoning and an innovative construction solution was required. Because of their dimensions and the amount of steelwork involved, temporary supports were ruled out as the current station entrance could not have supported large temporary works as there are underground lines just below street level (see box on previous page).

From the completed middle part of the frame the cantilevers will be formed by first erecting the tips of the cantilever and the bottom boom of the lowest floor, supported on temporary works. The tips will then be attached by strand jacks to the top of the completed frame, thereby holding the cantilever in place and allowing temporary works to be removed.

"We needed a lightweight solution and that's why we chose steel as the framing material."

There will be 12 hydraulically computer operated jacks positioned on each elevation and as the two cantilevers are progressively erected, the increased loads mean the jacks will absorb the extra loads and deflect them into the already completed parts of the structure.

Only when the cantilevers are fully erected will the strand jacks be removed. The cantilevers will by this stage be fully supported by metal decking and bracing, which will allow the concrete slabs to be poured.

The east and west elevations of the structure both feature three large cross bracings, known as X-frames, formed by two 16m long beams bolted together in the middle. Four of these are positioned along the 21m cantilevers and act as bookends to the cantilevers, taking loads down to foundation level.

Meanwhile, the front elevations of both of the cantilevers are formed by storey high trusses which help keep the spans rigid and pick up the loads from the secondary beams and transfer them to the X-frames. These trusses feature centre columns spaced at 6m intervals with conjoining diagonal ties, which in turn form one large truss which covers the whole elevation. The perimeter members of the trusses are 762mm CHS members, while internal members are slightly smaller 457mm CHS members.

"Timing of deliveries is playing a major role in this project, " sums up Alex Harper, Contracts Director for Watson Steel Structures. "Each truss features 33m long CHS members which are bolted together on site to form the 67.5m lengths, and these have to be brought to site at night which is when we will be erecting the cantilevers.

"As well as this we have erected the steelwork around the other trades as various stages of the job are overlapping, and as areas have been freed up after demolition we've moved in."

Steelwork for the central section of the project has been completed (as of early April) and work on the cantilever sections has now begun. The steel package is due to be completed by late July with the entire project scheduled for completion in June 2011.

FACT FILE
Queens Park Leisure Centre, St Helens, Merseyside
Main client: St Helens Council
Architect: Pozzoni
Main contractor: ISG
Structural engineer: Farebrothers
Steelwork contractor: EvadX
Steel tonnage: 100t
Project value: £4.1M

Above: The pool was dug prior to the steelwork being erected

Below: Blockwork cladding has required larger beams to be inserted

An exercise in steel

A new community leisure centre and swimming pool in St Helens, which incorporates a number of sustainable features, is making full use of steel's speed and ease of construction.

Currently under construction on the site of the town's former leisure centre, St Helens will soon have a new leisure facility containing a five-lane, 25m swimming pool, fitness suite, a community meeting room and a number of administrative offices.

Originally known as Boundary Road Baths, the old centre was based around pool facilities which were built more than one hundred years ago. Due to the age and condition of the building it would have cost more to repair and maintain this structure than replace it with new facilities.

Taking up the majority of the site's existing footprint, the new Queens Park Leisure Centre does however incorporate a retained sports hall from the old centre, which is undergoing a comprehensive programme of refurbishment both internally and externally. The new structure wraps around this older building on two elevations, and links into it along one facade.

Councillor Wally Ashcroft, Executive Member for Culture, Heritage and Sport said: "Queens Park will provide a valuable new sporting facility underpinning the Council's 'Active St Helens Strategy'. It will make a significant contribution towards getting more people active, improving their health and the well being of the wider community."

Craig Tatton, Managing Director of ISG's regional business, agrees: "The replacement or modernisation of costly and ageing leisure amenities is a key issue for many local authorities across the UK and this situation will become exacerbated as more facilities become unfit for purpose. Direct replacement, such as the Queens Park scheme, is a compelling argument as the community benefits from new purpose-built amenities, with dramatically reduced running costs thanks to vastly improved heating and lighting efficiencies."

As well as demolition, early works in the construction programme also included the installation of some 200 x 4.5m deep stone columns. The majority of these are located beneath the new swimming pool, which was excavated prior to the steel frame being erected.

Early in the design process for the new centre, a steel frame was chosen primarily for its speed and ease of construction. Although there were other considerations, such as the shape of the new structure, which incorporates a number of disparate elements such as a single and two storey section as well as a lean-to roof.

Steelwork erection was completed by EvadX during a three week programme, with a further one week needed to install metal decking as part of a composite steel/insitu concrete upper floor construction.

"Steel was also chosen because it is more versatile, particularly on a structure like the new centre which is not a regular shape," says Chris

Sage, Farebrothers' Project Engineer.

The two storey part of the new centre abuts the retained sports hall and consists of changing rooms and administrative offices on the ground floor, while upstairs there is a dance studio with sprung timber flooring, and a fitness centre boasting the latest cardiovascular and free weights training equipment.

Because the dance studio and fitness suite are located on the composite upper floor, vibration has been a consideration in its design. Checks, using SCI guidance, were carried out as there were anticipated cyclic loadings from both the dance studio and fitness suite.

Adjoining the two-storey area the swimming pool is housed in a single storey structure with a lean-to roof. Forming the long spans are a series of 13m-long rafters which will remain exposed, as an architectural feature, along with the associated ductwork.

Stability for the new steel frame is derived from a combination of cross bracing and portal bracing. "Basically cross bracing has been added to elevations where it can be hidden by the building fabric", explains Mr Sage. "For example, the front elevation of the two storey area comprises of a fully glazed façade, with nowhere to hide any cross bracing. Consequently portal bracing has been utilized in this elevation".

Another similar situation occurs at the meeting point of the pool area and the two-storey sector. This elevation comprises of either glazed screens to the viewing / cafeteria area or continuous openings into the pool changing areas at ground floor level.

"Cross bracing has been added to elevations where it can be hidden by the building fabric."

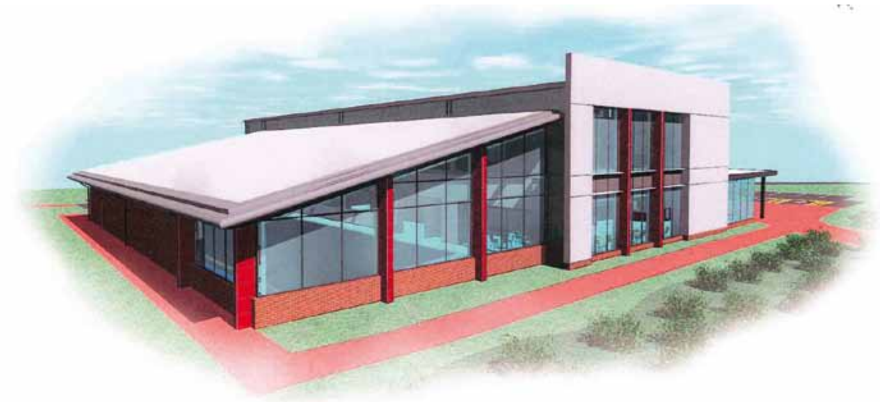
Internal partitions are predominantly built with blockwork, some of which is supported via flange plates attached to the undersides of steel beams in order to provide limited visibility of the supporting element.

Sustainability is also playing a key role in this project, and a number of environmental features have been included in the design including a combined heat and power unit, a passive ventilation system and energy efficient lighting throughout. Biodiversity will be encouraged across the site with significant landscaping and thoughtful planting designs as well as the installation of numerous bat boxes.

"Much of the material from the demolition process has been reused for landscaping mounds," comments ISG Senior Construction Manager Tony Dougan. This limited the amount of material leaving the site and lessened the project's impact on the surrounding community as there were fewer truck movements.

"The majority of the material being used for the new building is recylced including the glass and the aluminium for the cladding," adds Mr Dougan. "And of course the steelwork is 100% recyclable."

The project is scheduled for completion by October 2010.



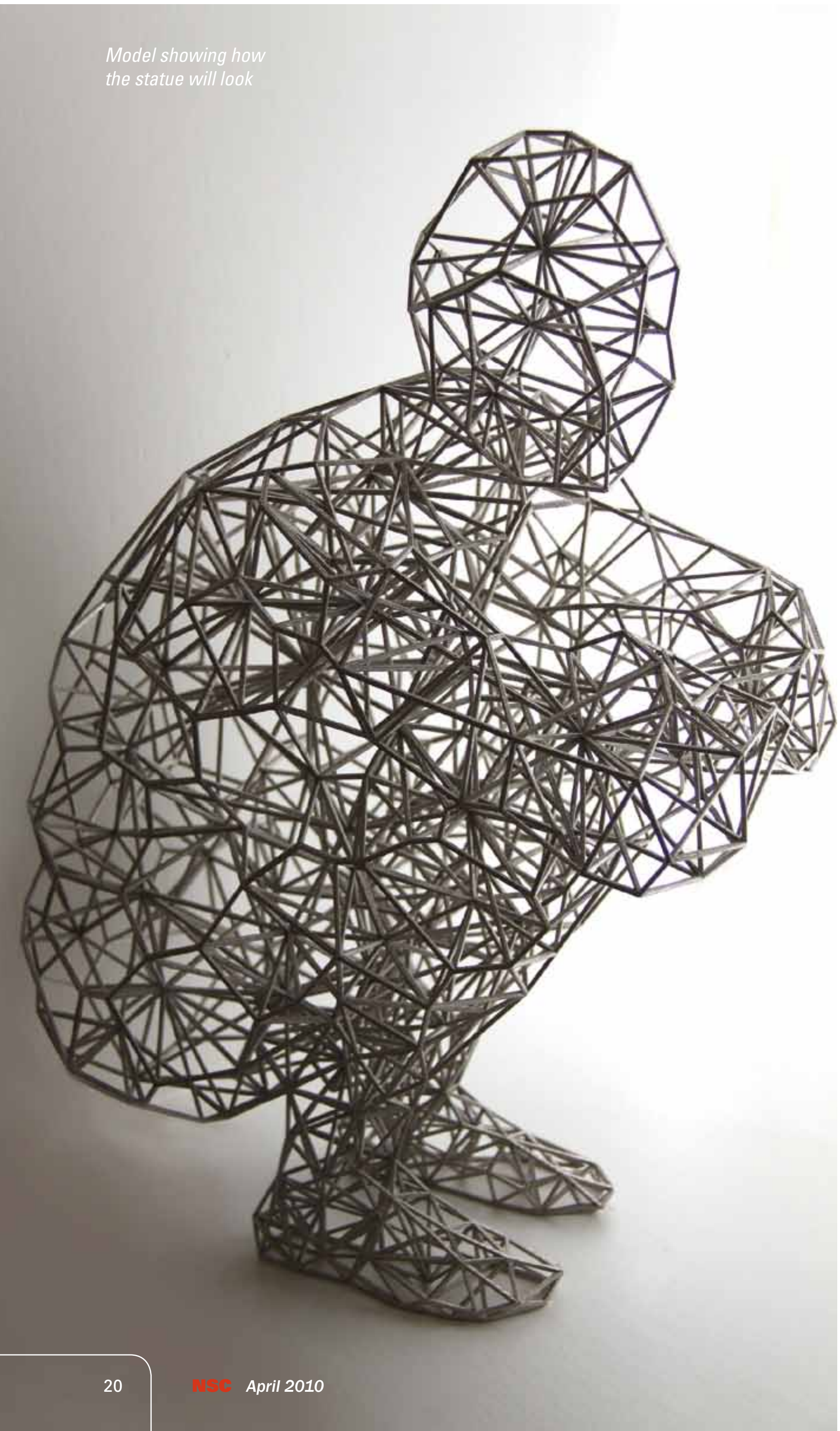
Above: Impression of the completed leisure centre including the refurbished retained hall

Below: A lean-to roof structure, formed with 13m long rafters, covers the pool area

Below: The upper level will house a dance studio and fitness suite

British steel goes Dutch

Consisting of more than 500 complex steel nodes and 16,000 bolts, a UK based steelwork contractor is currently fabricating the latest Antony Gormley masterpiece for a client in The Netherlands.



Model showing how the statue will look

The Dutch town of Lelystad has commissioned the latest unique statue designed by the prominent UK sculptor Antony Gormley. Renowned for the famous 'Angel of the North' his new creation is a 25m high crouching man, completely constructed from steel angle profiles.

Steelwork for this complex piece of modern art is being undertaken by Had Fab, based in Haddington near Edinburgh. The company has many years experience of producing complete structures, fixtures, fittings and towers for power and telecommunications.

Had Fab is now utilising this expertise to produce the crouching man statue. "We've been in contact with Mr Gormley discussing this project for about five years," says Had Fab's Managing Director Simon Harrison. "Numerous companies were initially contacted by him to produce the complex steelwork but most refused the job after completing feasibility studies."

Angle profiles for the statue are punched and sheared to length by the company's FICEP machinery before highly skilled labour intensive work is done to form the required 550 nodes.

Mr Harrison says his company's 'can do attitude' was eventually instrumental in securing this contract, however, while there are many challenges to overcome he has every confidence in the technology and the people in his employ.

Initially the statue evolved from a plaster of Paris model of Mr Gormley himself in the desired crouching position. This work formed a shell which was then taken to Cambridge University, who then produced a wire diagram by using surveying technology.

Once this initial shape was designed the wire diagram was then detailed in a Tekla Structures' programme and interfaced with Steel Projects' Winsteel to produce machine codes for Had Fab's FICEP machinery angle line.

Angle profiles for the statue are punched and sheared to length by the company's FICEP machinery before highly skilled labour intensive shaping of the material is done to form the required 550 nodes.

Producing these 2.5m diameter nodes is extremely time consuming, and Mr Harrison says some have up to 27 angles meeting together to form locating points around the structure. "Every angle member is a different length and are produced from sizes ranging from 60mm x 60mm to 200mm x 200m steel sections. We are fabricating directly from the computer model with a laptop on the shop floor, as conventional 2D drawings are not suitable for communicating the fabrication information that is needed by the shop floor assembly team," he adds.

In total there will be 32,000 holes punched or drilled in the angle profiles and the total weight of the structure will be 60t.

FACT FILE
The Crouching Man
Main client:
Government of Lelystad, The Netherlands
Architect:
Antony Gormley
Steelwork contractor:
Had Fab
Steel tonnage: *60t*

In total there will be 32,000 holes punched or drilled in the angle profiles.

Had Fab is currently fabricating and trial assembling the entire statue which has galvanised fully welded joints as well as bolted connections requiring some 16,000 bolts.

All of the angles are produced on a specially designed jig before being assembled in the company's yard.

Once the entire statue has been assembled and completed it will then be dismantled and shipped across to The Netherlands where Had Fab will reassemble it over a six week period.

Above: The statue's feet take shape in Had Fab's yard

Left: A typical complex node

FICEP machinery fits the profile

The crouching man is being produced on the latest FICEP HP16T6 CNC angle line. This unit is said to have numerous optional extras available and can be configured to meet the customer's precise requirements. The machine has an infeed transfer speed of up to 100m per minute and can be equipped with automatic feeding and loading, punching, drilling with tool changer, notching, marking utilising cassette or individual characters, quick change punch and die sets, quick change shear blades and automatic part unloading for the out feed conveyor. The machine was purchased prior to this prestigious project getting started and brings the total number of FICEP machines at Had Fab to four.

Mark Jones, FICEP's Managing Director, says: "We were delighted that Had Fab chose the FICEP machine to produce the hundreds of steel angle profiles required for this one-off unique structure. This project clearly demonstrates how technologically advanced CNC machinery and manual fabrication techniques can work together efficiently to produce highly complex structures. The technical challenges of the design, detailing, equipment performance and quality fabricators has been extensive. Had Fab's expertise and production capabilities were instrumental in securing this contract."

Excellence achieved at leisure centre

Sustainability and green credentials were the main drivers for a new leisure centre in Bletchley. NSC reports on a project which has achieved all of its aims with the aid of a steel frame.

Steel is more adaptable and flexible, so if the Council ever wished to add on extensions or even change the building's internal layout it could be done easier then if the structure was built with concrete.

Forming an integral part of Milton Keynes Council's ambitious 'Building a Better Bletchley' project, a new £21M Leisure Centre was officially opened last January. The building is an energy efficient and sustainable structure and one which will provide a much needed boost to the local community.

Overall the development consists of a three storey steel-framed leisure centre and swimming pool with composite floors, steel roof - varying from trussed, monopitch and portal - and clad with low level masonry.

The building can be divided into four main areas, a main sports hall which is a portal frame 9.1m high to the underside of its haunch; central main building area with openings for squash courts, an atrium and smaller sports halls/gyms; a third floor seven lane bowling alley; and a 25m eight lane swimming pool with a curved feature wall and a monopitch roof formed with Westok cellular beams which slope down at eight degrees and taper to oval columns at the perimeter. Each of these areas are interconnected to form one large building.

Built on a site adjacent to the existing centre, the project had undergone four years of consultation since receiving planning permission in September 2006. Milton Keynes Council set up a rigorous design review process upon architects Holder Mathias being appointed, liaising with key stakeholders such as English Heritage and Sport England.

Commenting on the project, Mark Lewis, Senior Architect at Holder Mathias Architects, says: "Our brief was to design a new state-of-the-art leisure centre that could replace the existing one, while aspiring to achieve the same status as a significant iconic structure to come.

"The vision for the scheme was to create a carefully integrated development with an inspiring public realm. The curved structures of the pool hall provide a new visual dynamic, while the design has been set out to maximise natural daylight and sustainability."

In order to achieve this desired architectural and sustainable vision, a steel frame was chosen for the project. Mr Lewis states that steel is more adaptable and flexible, so if the council ever wished to add-on extensions or even change the building's internal layout, it could be done, easier than if the structure was built with concrete. Throughout the structure there are partitions - such as in changing rooms - which could be removed to change the area's configuration.

Above: Exposed cellular beams form an architectural feature in the pool area

Project wins sustainability award

Bletchley Leisure Centre has been recognised with a BREEAM Award in the Bespoke category at the 2010 BREEAM Awards, held at the Ecobuild Arena in Earls Court, London during March.

The centre scored 79.6% which is an 'Excellent' rating, to beat off competition from several other top rated sustainable buildings, and was one of only 16 developments to receive an award at the ceremony. The awards recognise and reward those involved in the design and construction of the highest scoring buildings certified under BREEAM.

The centre was recognised for incorporating sustainable features such as biomass fuelled boilers, rainwater harvesting and natural ventilation.

Carol Atkinson, BRE Global Chief Executive, says: "This facility will bring a great deal of pleasure to the residents of Bletchley for years to come and it is a tribute to those involved in the project that they have achieved such an excellent standard."

Green credentials are important to the client so the Centre was designed to achieve an 'Excellent' BREEAM rating (see box story). The fact that steel is endlessly recyclable was another important factor in the material being specified.

Because of the functionality of the structure, with its many sports activity areas, column free spaces were obviously an over-riding requirement in the design. To achieve this there are some fairly big spans in the structure, most notably in the swimming pool hall and sports halls.

BWB Consulting says it worked closely with the project architect and SDC to develop the structural form to meet the requirements of the clients brief in the most cost effective manner without compromising the aesthetic qualities of the building form.

"We have 30m clear spans over the pool and by using cellular beams to accept the many services and leaving them fully exposed, we've made an architectural feature from the steelwork," adds Mr Lewis.

Another area with an even longer span is the hall which incorporates the bowling alley. Here 40m clear spans have been formed with a series of 2.5m deep trusses.

"We wanted to keep the structure as light as possible and forming these spans with concrete, for instance, would have meant a massively heavy structure," explains Mr Lewis.

Erecting the longest of spans meant steelwork contractor Mifflin Construction had to bring the sections to site in two pieces. Mifflin was on site four months erecting the project's steelwork as well as installing the metal decking and precast planks.

As the swimming pool is regarded as the centrepiece and the public face of the centre, it was erected first with the other halls and areas - which are separated from the pool by a curving feature wall - then built sequentially.

This curving wall not only divides the leisure centre, but also helps define the pool area as the main public focal point. This section of the structure's exterior is mostly fully glazed, allowing natural daylight to penetrate. Covering the pool and supported by the cellular beams is an unusual elliptically shaped roof, which again sets this part of the structure apart. Also included in this portion of the building is the centre's cafe and a covered seating area.

Next to the new structure, the existing leisure centre remained open throughout the construction programme, and it is now being demolished to make way for a new multi-storey car park which will not only serve the new leisure centre but also the nearby High Street.

'This could have been a challenge, but the existing centre never impinged on our construction programme," comments Keith Anderson, Project Manager for SDC Construction. "We initially did some road improvements which gave us a defined access and consequently our work and deliveries never interfered with the general public."

Summing up this highly successful project, Paul Sanders, Assistant Director for Leisure, Learning and Culture at Milton Keynes Council, says: "This has been a very fruitful project, many years in the planning, and we were pleased to be able to open the doors of the new look leisure centre at the start of the year with a facility that clearly has its eyes on limiting its environmental footprint and providing a significant revenue saving to the tax payers of Milton Keynes."

FACT FILE
Bletchley Leisure Centre, Buckinghamshire
Main client: Milton Keynes Council
Architect: Holder Mathias Architects
Main contractor: SDC Builders
Structural engineer: BWB Consulting
Steelwork contractor: Mifflin Construction
Steel tonnage: 620t

Powering ahead with steel

Three identical large steel-framed turbine halls are being erected in a row

FACT FILE
West Burton Power Station, Retford, Nottinghamshire
Main client: EDF Energy
Architect: EDF CIT
Main civil contractor: Kier Construction
Structural engineer: EDF CIT
Steelwork contractor: Fisher Engineering
Steel tonnage: 6,000t

Steel portal frames are the solution for three turbine halls for one of the UK's latest power stations. Martin Cooper reports on the construction of EDF Energy's new West Burton facility.

In order to meet future energy requirements EDF Energy is building a new 1,300MW Combined Cycle Gas Turbine (CCGT) power station at its West Burton site, near Retford, Nottinghamshire.

The new facility, which will be ready for commercial operation in 2011 and will supply enough energy for approximately 1.5 million homes, is being built adjacent to an existing 2,000MW coal fired power station, which means the site has much of the necessary infrastructure - such as access roads - already in place.

EDF Energy says the power station is being built using advanced, yet proven technology to provide an efficient and flexible plant to meet future energy supply requirements and to help its climate commitment to reduce the intensity of CO_2 emissions from electricity production by 2020.

CCGT power generation is said to be the most energy efficient and clean method of fossil fuel generation. It involves burning natural gas, which turns a gas turbine with the waste heat used to turn a steam turbine. To supply the power station a new 19km long underground gas pipeline will connect it with the National Transmission System in Lincolnshire.

The connection to the electricity transmission system will be via a new 1km long underground cable to the National Grid substation which already exists within the West Burton site boundary.

Work commenced on site in January 2008, with the main steelwork programme kicking off during the middle of last year. Many of the larger new structures on the site are steel-framed buildings, and this includes the three turbine halls.

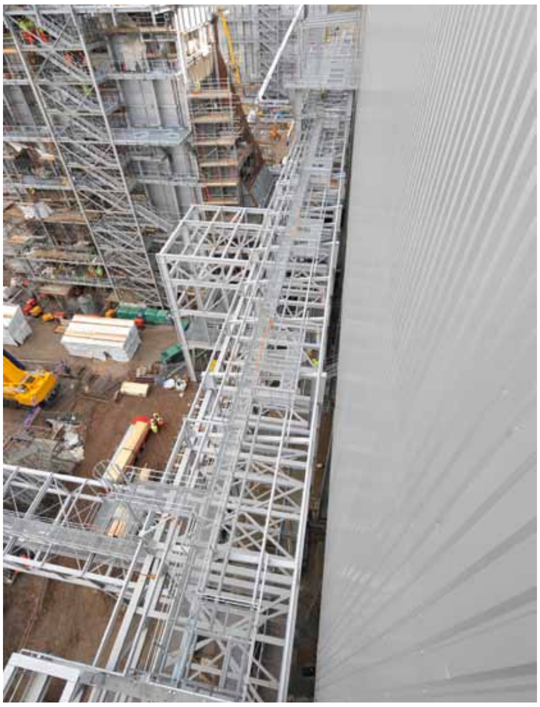
The turbine halls are huge and each one of these identical portal frames is 32m high to the eaves, and measures 82m long x 35m wide. Below ground the steel-framed halls are founded on CFA piles which were installed after the former pulverised fuel ash (PFA) depot site was excavated.

In order to keep truck movements to a minimum on surrounding roads, none of the PFA was moved offsite, as all of the material has been relocated to another part of the huge West Burton facility.

In order to give the turbine halls the necessary column free interiors a series of 4.5m deep x 35m wide trusses span the halls.

As the trusses are too long to lift or transport as one piece, they were brought to site in three equal sections. Two of these were bolted together on site, then this piece along with the remaining third section were lifted into place in a tandem lift involving two mobile cranes.

"Once they were in position the trusses were bolted together while being held up by the two cranes," explains Fisher Engineering Site Manager Pat McLaughlin. "However, we needed three cranes



Above: A pipe rack connects each turbine hall to a substation

Above: The new facility is adjacent to an existing coal fired power station

to erect the initial bay for each of the halls, as we needed two trusses up and braced for stability."

Supporting the roof trusses are a series of substantial fabricated plate girder columns spaced at 12.5m and 15m intervals. Brought to site in two 32m lengths these columns measure 1800mm x 600mm at the base, and were assembled on the deck before being erected as one 33t piece. Because the columns support an internal high level crane, the upper sections are smaller (weighing 9t instead of 24t) and have an L-shaped indent to accept the crane's track.

Fisher Engineering has erected the three structurally independent turbine halls sequentially as they are positioned adjacent to each other in a row. Once each of the frames is up, the concrete slabs are poured, and plinths and pedestals for the turbines and associated equipment are installed.

"One of our main challenges is working around the numerous other trades on this busy site," says Fisher Engineering Project Manager Barry Craig. "We've had to leave some large openings in the frames so equipment can be installed."

Each of the turbine halls has two internal floors which are installed once the main concreting programme is completed. Fisher will eventually install 12,000m^2 of open mesh flooring for the entire project.

"Some of the flooring has had to be left out while the turbine hall's equipment is installed. We then erect the missing sections of flooring once the internal installation has been completed," adds Mr Craig.

Sequencing of the overall works also has to take into account the turbine hall's height. Consequently the cladding (which will eventually add up to 40,000m^2 on the halls) can not begin until the floors have been completed, as they add the necessary stiffness and bracing to the structures.

Running parallel to each of the turbine halls is a pipe rack which connects each hall to its own substation. Each rack is identical and has multiple levels of steelwork for its associated pipework. Fisher will ultimately install 1,400t of steelwork for these structures, "which equates to more than 6,000 lifts as all of sections are small pieces,' says Mr Craig.

As well as the turbine halls, Fisher is also erecting numerous small steel-framed structures throughout the site. These include an oil storage building; a pumping station, three external stair structures; a demi water building, a pumps building and 12 transformer platforms.

Commenting on the project, Kier Construction Project Manager John Jenkins, says: "The steelwork programme has run to schedule with the required high degree of accuracy. All of the necessary milestones have been met during the construction of the turbine halls, which is highly important as so many trades are involved."

"Some of the flooring has had to be left out while the turbine hall's equipment is installed. We then erect the missing sections of flooring once the internal installation has been completed."

Below: Sequencing between the many on-site trades has been key to the project's success

Steel aids civic pride

Above: Steel erection has been phased around the installation of precast units

A new civic centre for Woolwich is the most prominent scheme currently under way as part of the area's large scale regeneration. Martin Cooper reports from South East London.

Today part of the London Borough of Greenwich, Woolwich was once a Kentish town and later a Metropolitan borough in its own right. A Victorian town hall, grand army barracks and a number of other large significant buildings, dotted around the town, are proof that Woolwich was once an important industrial and military centre.

As with many other parts of the UK, Woolwich is being regenerated and much of the work forms part of the larger Thames Gateway project, which aims to breathe new life into 40 miles of Thames riverfront and estuary land.

Several projects are currently under way to spruce up Woolwich town centre, adding new housing, retail space and landscaped squares. Situated directly opposite the existing town hall a new 18,000m^2 civic centre is under construction, a building which will accommodate the majority of the local council services under one roof, while also housing a new library and a business centre.

The new structure is a steel-framed building consisting of six floors built around two main concrete cores and one smaller central concrete riser. Above this the structure has a plant area, which covers the entire rooftop, and on top of this there is a feature glazed gallery.

Steelwork for this project is being undertaken by Billington Structures, working on behalf of main contractor Wates, and it will eventually erect close to 1,400t of structural steel for the job.

All of the floors are based around a repetitive 4.5m x 10.5m grid pattern, with fabricated beams used throughout. These members have been highly engineered to minimise structural depth, maximise service distribution as well as adding future flexibility. They have service holes, of varying sizes, and support precast planks on the bottom flange which in turn support prefabricated service modules with built-in pedestals to support the floor.

Steel erection has progressed in tandem with the installation of the precast units, and so the project is divided into phases. For each of the three phases steelwork has generally been erected up to level three, with the precast contractor following on behind.

While the precast units are being installed Billington has erected an adjacent phase up to level three, again in preparation for the follow-on trade. Once all of the phases up to the third level have been erected, Billington has then begun erecting the steelwork up to the sixth floor, using the same sequenced programme.

FACT FILE
Woolwich Civic Centre, London
Main client: Greenwich Council
Architect: HLM Architects
Main contractor: Wates
Structural engineer: Buro Happold
Steelwork contractor: Billington Structures
Steel tonnage: 1,400t
Project Value: £53M

Below: Steelwork is based around a regular grid pattern
Below right: Highly engineered fabricated cellular beams are used on every floor

Above: Impression of the new Civic Centre with its prominent top floor gallery

"By sequencing the steel erection in this manner we, and the other contractors, are able to make full use of the site's two tower cranes as floors are released earlier for follow on trades," explains Paul Hayes, Billington Structures Project Manager.

Temporary bracing is being installed along with the main frame steelwork, as there is not sufficient stability until the planks have been added. Once the precast floors are in place the bracing becomes superfluous and is removed and used on the next phase of the project.

Most of the civic centre's internal columns will be left exposed as architectural features, and consequently CHS members have been specified as they are considered to be more aesthetic.

To help increase fire resistance, the majority of these columns feature a bespoke arrangement of one CHS member inside another with both sections concrete filled.

The members have been highly engineered to minimise structural depth and maximise service distribution.

The tube in tube composite column infilled with concrete presents many advantages, according to Franck Robert, Buro Happold Associate Director. "For a given load it saves nearly half of the weight of steel compared with a traditional column section. It is inherently fire resistant and does not require post applied fire protection."

Under normal conditions the concrete infill, the outer and inner tubes are all working compositely to resist the load, however under fire conditions, where applied loads can be reduced, the outer tube becomes sacrificial and acts as the fire protection.

These CHS members are spliced at two floor intervals and are connected either via a cruciform connection or by an attached internal beam section. Most of the columns are concrete filled on site, apart from the ground floor or lowest members, which were brought to site already prepared.

Perched on the top of the structure, above one of the main cores, is the project's signature element, the Greenwich gallery. This is a 28m-long glazed box which cantilevers out by 6m along the front elevation and 2m at the back. This steel and glass box, which will be used as a multi-functional space and a viewing gallery, is formed by a grillage of steel beams at floor and roof level, while the structure is also skewed to the rest of the building lending some architectural presence to the rooftop.

Because of its position and the large cantilevers the gallery's floor structure has been kept as light as possible, and a timber floor infill has been specified.

"The gallery will provide a beacon and will be a landmark for the town centre as it will be lit up at night," says HLM Project Architect Chris Mee. "It will also be open to the public and accessed via a lift directly from the Centre's entrance lobby."

The gallery will offer some uninterrupted views along the River Thames and in order not to spoil the vista the structural mullions on the elevations have been kept as slender as possible.

As well as its rooftop feature the civic centre will be clad in a variety of materials - brickwork, stonework, curtain walling - giving it a modern and eye-catching appearance.

Sustainability has also played a key role in the design and the project team are currently aiming for a BREEAM 'Excellent' rating. A number of sustainable features have also been planned for the project including green and brown roofs, and rainwater harvesting.

The project is scheduled for completion in early 2011.

Member Resistances to BS 5950 and BS EN 1993-1-1

Do member resistances increase, decrease or remain the same according to the Eurocodes? Armed with copies of the "new" and "old" Blue Book, David Brown of SCI makes some comparisons.

The existing suite of British Standards are to be withdrawn at the end of this month. Despite the fact that the Building Regulations permit any (or no) design Standard to be used, it is anticipated that there will be an increased interest in the Eurocodes. The steelwork sector has been busy producing supporting material – several guides were published in November 2009, including the Eurocode version of the "Blue Book". The "Blue Book" is probably best known for the member resistances, and is used by many designers for manual design of beams and columns. This article merely uses the member resistance tables to make numerical comparisons between the two design Standards.

An important observation is that resistance is independent of loading, according to the Eurocodes. Thus the reduction in gravity loading under the Eurocode suite (around 8%) is entirely separated from the resistances given in the "Blue Book" and quoted in this article. Equally important is to note that the resistances given in the "Blue Book" incorporate the influence of the UK National Annex. As a more general comment, the influence of the National Annex (needed for the country where the structure is to be built) should never be underestimated – errors will be made if the relevant National Annex is not carefully consulted.

Members in Compression

Direct comparisons between members in compression are simple, as both "Blue Books" provide resistances for different lengths of members. The Eurocode version introduces an additional resistance for beam, column and channel sections, given as $N_{b,T,Rd}$ as shown in Figure 1. This is the torsional buckling resistance. Open sections may buckle in a torsional mode, but this is not critical for the UK range of open sections. The resistances given in the Eurocode "Blue Book" reassure users that the minor axis flexural resistance is the same or lower than the torsional buckling resistance, for a given length. Note in Figure 1 the change in nomenclature and axis – *N* is the Eurocode symbol for axial compression, b indicates buckling and Rd is the design resistance. The major and minor axis are y-y and z-z respectively.

203x203x46	$N_{b,y,Rd}$	1610
	$N_{b,z,Rd}$	1590
	$N_{b,T,Rd}$	1590

Figure 1: Presentation of compression resistance in the new "Blue Book"

203 UKC 46, S355 (resistances in kN)						
Buckling length (m)		2	4	6	8	10
BS 5950	Major	2020	1810	1460	1050	747
	Minor	1780	1140	648	399	267
BS EN 1993-1-1	Major	2010	1750	1390	1010	726
	Minor	1740	1100	635	395	266

305 × 165 × 40 UKB, S275 (resistances in kN)						
Buckling length (m)		2	4	6	8	10
BS 5950	Major	1370	1330	1270	1210	1070
	Minor	1200	688	359	213	140
BS EN 1993-1-1	Major	1360	1310	1240	1150	1040
	Minor	1150	679	359	214	142

150 × 75 × 18 Channel, S275 (resistances in kN)						
Buckling length (m)		2	4	6	8	10
BS 5950	Major	571	436	295	196	136
	Minor	353	130	63.2	37.0	24.2
BS EN 1993-1-1	Major	571	435	296	198	138
	Minor	353	132	64.3	37.7	24.7

150 × 150 × 10 Hot Finished SHS, S355 (resistances in kN)						
Buckling length (m)		2	4	6	8	10
BS 5950		1850	1470	855	510	334
BS EN 1993-1-1		1820	1400	831	504	334

It may be observed that the resistances are about the same. The resistance according to the Eurocode is lower in some cases, by a few percent.

Members subject to lateral-torsional bending

Comparisons between BS 5950 and BS EN 1993-1-1 are a little more involved, because of the way the

two Standards are formulated. The key difference is the way that the effect of a non-uniform bending moment diagram is managed. A uniform bending moment diagram is the most onerous case for lateral-torsional buckling – other shapes of bending moment diagram are less onerous, meaning a higher maximum moment may be carried. In BS 5950, a single resistance to lateral-torsional buckling is calculated, and the effect of a non-uniform bending moment managed with the m_{LT} factor, taken from Table 18. Thus in clause 4.3.6.2, the following relationship must be satisfied:

$M_x \le M_b / m_{LT}$ where M_x is the maximum major axis moment on the segment and m_{LT} is the equivalent uniform moment factor which ranges from 1.0 for a uniform bending moment diagram to 0.44 for a fully reversing bending moment diagram with equal (but opposite) end moments.

The designer extracts M_b from the "Blue Book" – which needs only to display one value - and introduces m_{LT} outside the calculation of M_b.

In BS EN 1993-1-1, the effect of a non-uniform moment is managed as part of the calculation of the buckling resistance, using a factor known as C_1. Thus the "Blue Book" must provide values of lateral-torsional buckling resistance for various values of C_1 as shown in Figure 2.

Lateral-torsional resistances are presented for values of C_1 between 1.0 and 2.75 – the designer must determine the actual value of C_1 and interpolate accordingly.

The following tables of comparisons indicate the m_{LT} factor and the C_1 factor that have been used to arrive at the tabulated values. The sections and bending moment shapes in the following tables have been chosen to reflect a range of situations.

Designation Cross section resistance (kNm) Classification	C_1 (1)
457x152x82	1.00
	1.50
$M_{c,y,Rd}$ = 480	2.00
$M_{c,z,Rd}$ = 63.6	2.50
Class = 1	2.75

Figure 2
Presentation of lateral-torsional buckling resistance

533 × 210 × 92 UKB, S275 (resistances in kNm) m_{LT} = 1.0 C_1 = 1.0 (a uniform bending moment diagram)						
Buckling length (m)		2	4	6	8	10
BS 5950	(M_b/m_{LT})	629	430	286	206	159
BS EN 1993-1-1		634	478	344	257	203

457 × 191 × 67 UKB, S275 (resistances in kNm)
m_{LT} = 0.925
C_1 = 1.13 (a parabolic bending moment diagram due to a UDL)

Buckling length (m)		2	4	6	8	10
BS 5950	(M_b/m_{LT})	405	266	172	122	94.8
BS EN 1993-1-1		401	301	214	156	124

305 × 165 × 40 UKB, S275 (resistances in kNm)
m_{LT} = 0.925
C_1 = 1.13 (a parabolic bending moment diagram due to a UDL)

Buckling length (m)		2	4	6	8	10
BS 5950	(M_b/m_{LT})	169	107	70.8	51.9	41.0
BS EN 1993-1-1		169	133	96	71.4	57.1

406 × 140 × 46 UKB, S275 (resistances in kNm)
m_{LT} = 0.6
C_1 = 1.77 (a triangular bending moment diagram – zero at one end)

Buckling length (m)		2	4	6	8	10
		199	107	66.3	47.5	37.1
BS 5950	(M_b/m_{LT})	244	178	111	79.2	61.8
BS EN 1993-1-1		244	195	136	96.3	77.4

It should be observed that the lateral-torsional buckling resistance according to the Eurocode is considerably higher than that according to BS 5950 – in some cases as much as 30%. The increased resistance is not so noticeable at lower slenderness, but is significant at reasonable lengths.

Clearly, not all beams are governed by lateral-torsional buckling. In some circumstances, it may be that serviceability criteria such as dynamics may become more significant if a smaller beam is used. However, in general, the increase in lateral-tosrional buckling resistance is an attractive benefit of Eurocode design.

Shear Resistance

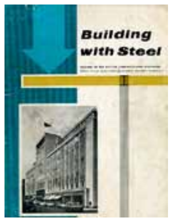
It would be unusual to find that the shear resistance of a beam were important. In most cases, bending resistance or deflection will govern the choice of a member. The shear resistance of members differs very slightly between BS 5950 and BS EN 1993-1-1, because both the expression for the shear resistance and the shear area to be used are slightly different.

Shear Resistance (kN)

Member	BS 5950	BS EN 1993-1-1
533 × 210 × 82, S275	837	865
406 × 140 × 46, S275	452	473
305 × 165 × 40, S275	300	319

Conclusions

Many practicing designers do few calculations using the code clauses, preferring instead to use software or tables of member resistance. The Eurocode "Blue Book" is available, and once familiar with essential differences in presentation, should become as easy to use as the BS 5950 version. The proof of the pudding is in the actual resistances: generally "about the same" for most things, but a significant increase in lateral-torsional buckling.



Steel Bridges

Above: Samlesbury Bridge spans the River Ribble on the Preston By-Pass. It is an all welded structure with two 120 ft side spans and a 180 ft centre span.

Below top: One of the eight bridges forming part of the Catterick By-Pass scheme, the Cataractonium Bridge is here shown during construction. The new universal beam is being used in its construction.

Below middle: The arch of the Conway Road Bridge – which replaces the 132-year-old suspension bridge – has a 310 ft span carried on four steel ribs.

Bottom: Steel bridges carrying traffic over a road in the Queens area of New York. These are typical of the smaller American bridges.

SPEEDING THE FLOW

The continued injection of new vehicles into the already sluggish flow along Britain's main traffic arteries has long threatened the country with a state of vehicular thrombosis. Fortunately, however, the symptoms have been recognised, the disease has been diagnosed, and now the remedy of wider and faster roads is being applied.

These plans have called for the building of a great number of bridges to carry the new roads over rivers and existing roads, and the majority of bridges being built in Britain today are directly connected to the road programme.

STEEL SPEEDS ERECTION

The need for speed of erection is vital in bridge construction, especially where the work interferes with an existing road system. Steel meets this need more efficiency than any other building material: the time for assembly of steel on site is less than for its competitors by a considerable margin. It can be fabricated away from the site and erected as soon as the abutments and piers are ready to receive it. It also requires less temporary support during erection and there is therefore a minimum of interference with the space beneath the structure.

One of the most publicised aspects of the new road programme has been the Preston By-Pass, and a good example of a bridge on this By-Pass is the Samlesbury Bridge – a three span structure across the River Ribble. It is of all-welded construction, and each of the eight triple steel girders incorporated in its 420ft length weighs 158 tons. The girders were conveyed to site in lengths of up to 105ft and the joints were site welded. The bridge carries dual carriageways, each 24ft wide, and a 32ft wide centre reserve has been allowed for future developments.

LONG SPAN PROBLEMS

Various difficulties confront bridge designers when it comes to spanning long distances, and the Queenshill Bridge – spanning the River Severn between Tewkesbury and Upton-on-Severn – shows how steel can help to reduce such difficulties to a manageable level. The total length of the bridge is 2,468 ft; the middle 500 ft comprises two 131ft river anchor spans, two 65ft cantilever arms and a 108ft suspended span, all of steel construction. The use of steel avoids the necessity for sinking piles in the river bed.

PRESERVING CHARACTER

A noteworthy feature of the Conway Road Bridge – a single-span steel arched type – is the way in which the design has been managed so it blends with its background. The bridge, which replaces the 132-year-old suspension bridge, has a 310 ft deck span comprising four steel ribs, supporting a deck of steel buckle plate and concrete, The arch is faced with fascia plates.

Another example of this blending of modern structures with their surroundings can be seen in the Queens area of New York. Here it was necessary to construct two bridges, one over the other, without interfering with the character of the surroundings. This was accomplished by using simply-styled steel structures on foundations faced with natural stone.

INCREASING EFFICIENCY

The bridge building side of the structural steelwork industry is today making use of the newly available universal beams which are described elsewhere in this issue. The Cataractonium Bridge incorporated universal beams 36in by 16½in in its two 56 ft sides pans and the 75 ft centre span. The reinforced concrete decking for this bridge – which is one of the eight built for the Catterick By-Pass scheme – will be a composite part of the whole structure.

THE FUTURE

All these bridges, large and small, are making a truly vital contribution to the problem of speedily supplying all countries with the efficient road systems todays traffic demands. In view of the advantages that steel has to offer – prefabrication, speed of erection, versatility – it is not surprising that this well tried medium is so widely favoured.

Aviation House – Gatwick Airport

For: Civil Aviation Authority Safety Regulation Group

Architects:
The Fitzroy Robinson Partnership

Structural Engineers:
Ove Arup & Partners

Steelwork Contractor:
Robert Watson & Co (Steelwork) Limited

Main Contractor:
Bovis Construction Limited

The new office Headquarters of the CAA's Safety Regulation Group was designed to increase the efficiency of the group and to improve staff communications within a building bold and compromisingly modern in appearance. The finished building is both comfortable and cost-effective.

The building has a steel frame with hightech facades of tinted glass for solar control and grey powder coated aluminium panels. The two wings of the office are built around a central atrium which admits a high level of natural light to the open floor plan spaces. These wings are connected at link bridges at each level, the supports of which are made in exposed compsoite steel. The Building Control Officer recognised that, due to its thickness this steel had a fire rating in its own right and agreed that fire protection could be provided by intumescent paint rather than more conventional spray or dry clad systems.

The overall percieved bulk of the building is skilfully reduced by landscaped terraces at second and third fllor level and the length of both office wings is relieved by the addition of two vertical escape towers. Sun shading devices above each window (which doubles as maintenance walkways) add interest and variety to the elevations, facilitate window cleaning and significantly reduce the air conditioning load neccessary because the building had to be sealed to reduce noise penetration from the nearby airport.

The CAA required the building to be partially completed in early 1988 and ready for occupation in June. The tight 19-month production schedule necessitated the adoption of a fast track method of construction and also influenced the decision to use steel for the framework.

Work began on site in August 1986 and the £23m building was handed over on 7 March 1988. It was officially opened by the Duke of Gloucester on 23 June 1988. £1.3m of the total contract value was used for the fit-out.

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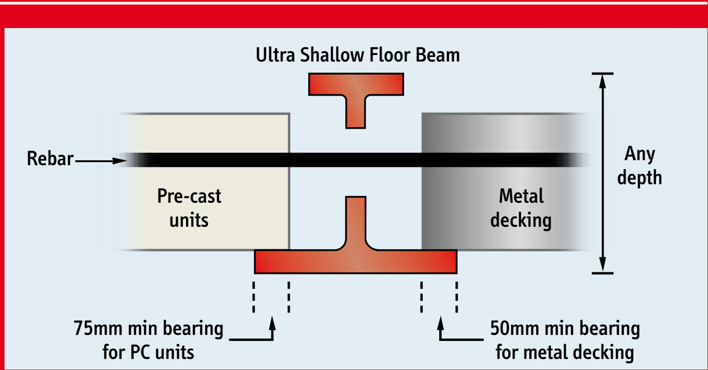

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AD 344
Levelling techniques for composite floors

The purpose of this Advisory Desk note is to highlight to designers the importance of considering potential levelling techniques of composite floor slabs in relation to achieving the specified tolerances and a safe design. Levelling methods are covered and the issues of pre-cambering, propping of decking, ponding, flatness and design approaches are discussed

Designers often assume constant nominal slab thickness for sizing beams and often include some allowance for ponding when designing decking in a composite floor. However, moves from traditional levelling methods to laser-based methods in recent years have meant that it is now important to consider the implications for structural design because the ponding effects can be much greater.

Traditional levelling of concrete

Traditional levelling of wet concrete for composite slabs is normally carried out using tamping rails or levelling pins set to the intended structural floor level (SFL) and supported on the steel beams. This means that any initial curvature and deviation from level of the beams is not reflected in the initial tamping level, but the final surface after casting will inevitably reflect the change in deflected shape of the beams. Consequently, the finished surface will not be flat but will have some modest sagging or 'dishing' in the floor surface. However, construction using this levelling technique usually provides an adequate control of flatness and a good control of concrete thickness.

An alternative levelling technique can be used to give a constant thickness of concrete relative to the beams - the tamping rails or levelling pins are set a constant distance above the supporting beams. This means that both the initial level and curvature of the beam are reflected in the initial tamping level, but a constant thickness of concrete should be achieved. This method does not give as good a control of the floor surface profile as the previous technique but it does give good control of concrete thickness.

Additional concrete thickness will arise in both techniques as a result of deflection of the decking and ponding of the concrete between the beams. This will not affect the flatness of the surface but does need to be considered in the design of the decking.

Modern laser levelling of concrete

Modern laser techniques of levelling concrete involve using the 'rigid' datum from a column rather than on a 'flexible' beam. Levelling equipment is used to produce a level upper concrete surface irrespective of the deflection of supporting elements or thickness of the concrete being laid; a technique commonly known as 'flood pour'. Consequently, a much more accurate level and flatness can be achieved, although the level of freshly laid areas might be affected to some degree by adjacent areas being laid, as the pouring progresses. However, considerably more concrete is likely to be needed with this method, depending on the deflections of the supporting beams. The extra weight and volume can be significant. In practice, additional concrete thicknesses of 30 mm or more at mid-bay have been recorded on slabs constructed using the flood pour technique.

Precambering

In situations where the beam deflection would be excessive, say, greater than 25 mm, beams can be pre-cambered, but care is needed when specifying the precamber. Unless the traditional levelling 'constant thickness' technique is used, there is a risk that there will be insufficient cover to the mid-span of the beams. Traditionally, engineers have specified a pre-camber of only ⅔ to ¾ of the calculated simply supported deflection of the beam, or up to half the concrete cover to the decking (whichever less). Doing so will greatly reduce the risk of a thin slab when the other levelling techniques are used.

Propping of the decking

Propping the decking is an effective means to limit the deflection of the decking under the weight of wet concrete and thus reduce the magnitude of ponding. However, use of propping in this way should be considered at the design stage and not introduced as an afterthought on site. When a composite slab is propped during construction, there is a higher demand on the shear connection between the decking and the concrete than in an unpropped slab, as a propped slab has to support the self weight of the concrete through composite action. Consequently, a propped slab will have a higher degree of creep deflection under imposed loads than an unpropped slab, as well as the additional deflection of the decking under the self weight of the concrete. A higher percentage of reinforcement is specified for propped slabs to limit cracking over the supporting beams, and this clearly needs to be specified at the design stage.

Design for the effects of ponding

In BS 5950-4, the limit on the residual deflection of the soffit of the deck (after concreting) is given as span/180 (but not more than 20 mm), which may be increased to span/130 (but not more than 30 mm) if the effects of ponding are included explicitly in the design. However, when the deflection of the decking under the nominal design concrete thickness exceeds one tenth of the slab depth, the extra weight should be included in the design of the composite slab and supporting steel beams.

In the Eurocodes, the construction loads during concreting are given in BS EN 1991 1 6, and BS EN 1994-1-1 gives rules for the extra weight due to ponding for 'profiled steel sheeting used as shuttering', Clause 9.3.2 states that, if the deflection of the bare steel decking is greater than 1/10 of the slab depth, ponding should be included in the calculation of the self-weight. Further, it states that ponding should be calculated under loads comprising the self weight of the decking plus that of the wet concrete (including the reinforcement), calculated at the serviceability limit state. Ponding may be allowed for by considering an overall increase in thickness of concrete of 0.7 times the maximum deflection. No mention is made in BS EN 1994 1 1 of allowing for ponding in the design of beams, but it is recommended that if ponding has to be included in the design of the decking it should be included in the design of the beams as well. It should also be noted that the wet weight of the concrete, including the ponding, is treated as a 'variable action' in the Eurocodes.

Flatness and level tolerances

The key consideration with regards to the specification of tolerances is the building use; buildings such as hospitals may require tight level and flatness tolerances, whereas office structures may not. The requirements in the specification need to be achievable: it is not possible to construct a composite slab to very tight level and flatness tolerances because of the deflections of the beams. However, tight tolerances are not necessary for most applications, and deviations can be taken up with screeds, levelling compounds or a raised floor. Where isolated areas in a building have more onerous flatness requirements, they can be achieved by using levelling compounds or screeds locally. Extensive grinding should not be used to modify flatness, as it can significantly reduce the slab thickness.

For the rare occasions where levelling compounds and screeds cannot be used, and tight level and flatness tolerances are required, the supporting beams will need to be designed to limit deflections to values which correlate with the required top surface tolerances. This could have significant implications for the cost of the beams.

The following general tolerances for levels are given in references 1, 2 and 3, relative to the level of the datum (normally structural floor level):

±15 mm on top surface of concrete, measured at a column

±10 mm on top surface of supporting steel beams at a column position

The slab thickness tolerance at a column position will be about ±20 mm using the above values. Further information on level and flatness tolerances is available in references 1 and 2.

Recommended approach for designers

The overriding importance is to achieve a safe building which meets the client's requirements. Where possible, the designer should consult the contractor on how the floor will be levelled to meet the specification. Where a tight tolerance > p38

New and Revised Codes & Standards

(from BSI Updates March 2010)

CORRIGENDA TO BRITISH STANDARDS

BS EN 1993-1-10:2005
Eurocode 3. Design of steel structures. Material toughness and through-thickness properties
CORRIGENDUM 3
Also incorporates Corrigenda 1 & 2

BS EN 1993-1-11:2006
Eurocode 3. Design of steel structures. Design of structures with tension components
CORRIGENDUM 1

BS EN 1993-2:2006
Eurocode 3. Design of steel structures. Steel bridges
CORRIGENDUM 1

BS EN 1993-3-1:2006
Eurocode 3. Design of steel structures. Towers, masts and chimneys. Towers and masts.
CORRIGENDUM 1

BS EN 1997-1:2004
Eurocode 7. Geotechnical design. General rules
CORRIGENDUM 1

BRITISH STANDARDS WITHDRAWN

BS 449-2:1969
Specification for the use of structural steel in building. Metric units
Superseded by BS EN 1993-1-1:2005, BS EN 1993-1-5:2006, BS EN 1993-1-8:2005, BS EN 1993-1-10:2005, BS EN 1993-5:2007 and BS EN 1993-6:2007

BS 4076:1989
Specification for steel chimneys
Superseded by BS EN 1993-3-2:2006

BS 4604-1:1970
Specification for the use of high strength friction grip bolts in structural steelwork. Metric series. General grade
Superseded by BS EN 1993-1-8:2005

BS 4604-2:1970
Specification for the use of high strength friction grip bolts in structural steelwork. Metric series. Higher grade (parallel shank)
Superseded by BS EN 1993-1-8:2005

BS 5400-1:1988
Steel, concrete and composite bridges. General statement
Superseded by BS EN 1990:2002+A1:2005 and BS EN 1991-1-7:2006

BS 5400-2:2006
Steel, concrete and composite bridges. Specification for loads
Superseded by BS EN 1990:2002+A1:2005 and BS EN 1991-1-7:2006

BS 5400-3:2000
Steel, concrete and composite bridges. Code of practice for design of steel bridges
Superseded by BS EN 1993-1-1:2005, BS EN 1993-1-5:2006, BS EN 1993-1-8:2005, BS EN 1993-1-10:2005 and BS EN 1993-2:2006

BS 5400-5:2005
Steel, concrete and composite bridges. Code of practice for design of composite bridges
Superseded by BS EN 1994-2:2005

BS 5400-6:1999
Steel, concrete and composite bridges. Specification for materials and workmanship, steel
Superseded by BS EN 1090-2:2008

BS 5400-7:1978
Steel, concrete and composite bridges. Specification for materials and workmanship, concrete, reinforcement and prestressing tendons
Superseded by BS EN 1992-2:2005

BS 5400-8:1978
Steel, concrete and composite bridges. Recommendations for materials and workmanship, concrete, reinforcement and prestressing tendons
Superseded by BS EN 1992-2:2005

BS 5400-10:1980
Steel, concrete and composite bridges. Code of practice for fatigue
Superseded by BS EN 1993-1-9:2005

BS 5950-1:2000
Structural use of steelwork in building. Code of practice for design. Rolled and welded sections
Superseded by BS EN 1993-1-1:2005, BS EN 1993-1-5:2006, BS EN 1993-1-8:2005, BS EN 1993-1-10:2005, BS EN 1993-5:2007 and BS EN 1993-6:2007

BS 5950-2:2001
Structural use of steelwork in building. Specification for materials, fabrication and erection. Rolled and welded sections
Superseded by BS EN 1090-2:2008

BS 5950-4:1994
Structural use of steelwork in building. Code of practice for design of composite slabs with profiled steel sheeting
Superseded by BS EN 1994-1-1:2004

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on level and flatness is required, either very stiff supporting beams or laser levelling could be considered. However, the use of laser levelling will result in extra thickness of concrete (because of the deflection of the supporting beams and decking) unless this is mitigated by specifying stiffer beams. The designer should also consider localised solutions within a building, and refer the specification back to the client if the required tolerances for the slab surface are considered unnecessarily tight – not least because money can be saved. If consultation is not possible then the designer should make the design assumptions quite clear.

The designer should not rely on the design of beams using software without considering deflections at the construction stage. The potential thickness of concrete after casting should be considered. It is important that the ponding levels over the decking, together with the ponding due to the deflection of the beams, are considered at the design stage. The combined deflection of the decking and beams should also be considered in relation to the installation of services within the floor zone. Where laser levelling is specified, it is prudent to make the contractor aware that the concrete volume should not be estimated on just the nominal thickness of the slab.

Contact: J W Rackham
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Email: advisory@steel-sci.com

References

(1) *RACKHAM, J.W, COUCHMAN, G.H and HICKS, S.J. Composite Slabs and Beams Using Steel Decking: Best Practice for Design and Construction, 2nd edition (P300), The Steel Construction Institute and MCRMA, 2009.*
(2) *Good Concrete Guide 5 — Composite Concrete Slabs on Steel Decking Construction, The Concrete Society and The Association of Concrete Industrial Flooring Contractors*
(3) *National Structural Steelwork Specification for Building Construction (NSSS), 5th edition, BCSA Publication 203/07 SCI P-203, 2007*

The SCI gratefully acknowledges comments received during the drafting of this note from members of the MCRMA and The Concrete Society.

BS 5950-5:1998
Structural use of steelwork in building. Code of practice for design of cold formed thin gauge sections
Superseded by BS EN 1993-1-3:2006

BS 5950-6:1995
Structural use of steelwork in building. Code of practice for design of light gauge profiled steel sheeting
Superseded by BS EN 1993-1-3:2006

BS 5950-7:1992
Structural use of steelwork in building. Specification for materials and workmanship: cold formed sections
This standard has been withdrawn as it is no longer relevant

BS 5950-8:2003
Structural use of steelwork in building. Code of practice for fire resistant design
Superseded by BS EN 1993-1-2:2005

BS 5950-9:1994
Structural use of steelwork in building. Code of practice for stressed skin design
Superseded by BS EN 1993-1-3:2006

BS 6399-1:1996
Loading for buildings. Code of practice for dead and imposed loads
Superseded by BS EN 1991-1-1:2002 and BS EN 1991-1-7:2006

BS 6399-2:1997
Loading for buildings. Code of practice for wind loads
Superseded by BS EN 1991-1-4:2005

BS 6399-3:1998
Loading for buildings. Code of practice for imposed roof loads
Superseded by BS EN 1991-1-3:2003

BS 8002:1994
Code of practice for earth retaining structures
Superseded by BS EN 1997-1:2004

BS 8004:1986
Code of practice for foundations
Superseded by BS EN 1997-1:2004

BS 8100-1:1986
Lattice towers and masts. Code of practice for loading
Superseded by BS EN 1993-3-1:2006

BS 8100-2:1986
Lattice towers and masts. Guide to the background and use of Part 1 'Code of practice for loading'
Superseded by BS EN 1993-3-1:2006

BS 8100-3:1999
Lattice towers and masts. Code of practice for strength assessment of members of lattice towers and masts
Superseded by BS EN 1993-3-1:2006

BS 8100-4:1995
Lattice towers and masts. Code of practice for loading of guyed masts
Superseded by BS EN 1993-3-1:2006

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT – ADOPTIONS

10/30165712 DC
BS ISO 898-2 Mechanical properties of fasteners made of carbon steel and alloy steel. Part 2. Nuts with specified proof load values. Coarse thread

10/30165716 DC
BS ISO 898-6 Mechanical properties of fasteners made of carbon steel and alloy steel. Part 6. Nuts with specified proof load values. Fine pitch thread

10/30207380 DC
BS ISO 5952 Continuously hot-rolled steel sheet of structural quality with improved atmospheric corrosion resistance

CEN EUROPEAN STANDARDS

EN 1991-1-4:-
Eurocode 1. Actions on structures. General actions. Wind actions
CORRIGENDUM 1 January 2010 to EN 1991-1-4:2005

Steelwork contractors for buildings

BCSA is the national organisation for the steel construction industry.
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 Directory General, BCSA, 4 Whitehall Court, London SW1A 2ES
Tel: 020 7839 8566 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
- **QM** Quality management certification to ISO 9001

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	Contract Value (1)
A C Bacon Engineering Ltd	01953 850611			●	●		●										Up to £1,400,000
ACL Structures Ltd	01258 456051			●	●	●	●				●				●		Up to £3,000,000
Adey Steel Ltd	01509 556677				●	●	●	●		●	●			●	●		Up to £3,000,000
Adstone Construction Ltd	01905 794561			●	●	●											Up to £4,000,000
Advanced Fabrications Poyle Ltd	01753 531116				●		●	●	●	●	●				●	✓	Up to £800,000
Andrew Mannion Structural Engineers Ltd	00 353 90 644 8300		●	●	●	●	●	●			●	●		●		✓	Up to £3,000,000
Angle Ring Company Ltd	0121 557 7241												●				Up to £1,400,000
Apex Steel Structures Ltd	01268 660828				●		●			●	●						Up to £800,000
Arromax Structures Ltd	01623 747466	●		●	●	●	●	●	●		●	●					Up to £800,000
ASA Steel Structures Ltd	01782 566366			●	●	●	●			●	●			●	●		Up to £800,000*
ASD Westok Ltd	01924 264121												●				Up to £6,000,000
ASME Engineering Ltd	020 8966 7150				●					●	●			●	●	✓	Up to £1,400,000*
Atlas Ward Structures Ltd	01944 710421		●	●	●	●	●	●	●	●	●	●		●	●	✓	Above £6,000,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●		●							●			Up to £2,000,000
AWF Steel Ltd	01236 457960				●				●	●	●			●	●		Up to £400,000
B D Structures Ltd	01942 817770			●	●	●	●				●			●			Up to £1,400,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●				✓	Up to £2,000,000
Barnshaw Section Benders Ltd	01902 880848												●			✓	Up to £800,000
Barrett Steel Buildings Ltd	01274 266800			●	●	●	●									✓	Up to £6,000,000
Barretts of Aspley Ltd	01525 280136			●	●	●				●	●			●	●		Up to £3,000,000
BHC Ltd	01555 840006	●	●	●	●	●	●							●			Above £6,000,000
Billington Structures Ltd	01226 340666		●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000
Bone Steel Ltd	01698 375000	●	●	●	●	●	●			●	●	●		●		✓	Up to £6,000,000*
Border Steelwork Structures Ltd	01228 548744			●	●	●	●			●	●				●		Up to £3,000,000
Bourne Construction Engineering Ltd	01202 746666		●	●	●	●	●	●	●	●	●	●	●	●		✓	Above £6,000,000
Browne Structures Ltd	01283 212720				●			●							●		Up to £400,000
Cairnhill Structures Ltd	01236 449393				●	●	●	●		●	●			●	●	✓	Up to £1,400,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●			●	●		●		✓	Up to £6,000,000
Cleveland Bridge UK Ltd	01325 502277	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000*
CMF Ltd	020 8844 0940				●		●	●		●	●				●		Up to £6,000,000
Cordell Group Ltd	01642 452406	●			●	●	●	●	●	●	●					✓	Up to £3,000,000
Cougar Steel Stairs Ltd	01274 266800									●					●	✓	Up to £6,000,000*
Coventry Construction Ltd	024 7646 4484			●	●	●	●		●	●	●			●	●		Up to £1,400,000
Crown Structural Engineering Ltd	01623 490555			●	●	●	●		●		●			●		✓	Up to £800,000
D A Green & Sons Ltd	01406 370585		●	●	●	●	●	●	●	●	●	●		●	●	✓	Up to £6,000,000
D H Structures Ltd	01785 246269				●						●						Up to £40,000
Deconsys Technology Ltd	01274 521700				●					●				●	●		Up to £200,000
Discain Project Services Ltd	01604 787276				●					●	●				●	✓	Up to £1,400,000
Duggan Steel Ltd	00 353 29 70072		●	●	●	●	●	●			●					✓	Up to £6,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●		✓	Up to £6,000,000
Emmett Fabrications Ltd	01274 597484			●	●	●	●							●			Up to £1,400,000
EvadX Ltd	01745 336413			●	●	●	●	●	●	●	●	●				✓	Up to £3,000,000
F J Booth & Partners Ltd	01642 241581			●	●		●				●				●	✓	Up to £4,000,000
Fisher Engineering Ltd	028 6638 8521		●	●	●	●	●	●	●	●	●	●				✓	Above £6,000,000
Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	Contract Value (1)

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	Contract Value (1)
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●			●						Up to £3,000,000
Gibbs Engineering Ltd	01278 455253				●		●	●		●	●				●	✓	Up to £200,000
GME Structures Ltd	01939 233023			●	●		●	●		●	●			●	●		Up to £800,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●			Up to £1,400,000
Graham Wood Structural Ltd	01903 755991		●	●	●	●	●	●	●	●	●	●		●			Up to £6,000,000
Grays Engineering (Contracts) Ltd	01375 372411				●			●		●	●				●		Up to £100,000
Gregg & Patterson (Engineers) Ltd	028 9061 8131			●	●	●	●	●				●				✓	Up to £4,000,000
H Young Structures Ltd	01953 601881			●	●	●	●	●			●						Up to £2,000,000
Had Fab Ltd	01875 611711								●		●				●	✓	Up to £1,400,000
Hambleton Steel Ltd	01748 810598		●	●	●	●	●	●				●		●		✓	Up to £6,000,000
Harry Marsh (Engineers) Ltd	0191 510 9797			●	●	●	●				●	●					Up to £2,000,000
Henry Smith (Constructional Engineers) Ltd	01606 592121			●	●	●	●	●									Up to £6,000,000
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●		Up to £4,000,000
Hills of Shoeburyness Ltd	01702 296321									●	●				●		Up to £800,000
J Robertson & Co Ltd	01255 672855									●	●				●		Up to £200,000
James Bros (Hamworthy) Ltd	01202 673815			●	●		●			●	●	●			●	✓	Up to £2,000,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●					●		●			Up to £6,000,000*
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●						Up to £1,400,000
Leonard Engineering (Ballybay) Ltd	00 353 42 974 1099			●	●	●	●				●						Up to £3,000,000
Lowe Engineering (Midland) Ltd	01889 563244									●	●			●	●	✓	Up to £400,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●				●	✓	Up to £3,000,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●		Up to £1,400,000
Mabey Bridge Ltd	01291 623801	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000
Maldon Marine Ltd	01621 859000				●			●	●	●					●		Up to £1,400,000
Midland Steel Structures Ltd	024 7644 5584			●	●	●	●			●	●	●		●	●		Up to £2,000,000
Mifflin Construction Ltd	01568 613311		●	●	●	●	●				●						Up to £3,000,000
Milltown Engineering Ltd	00 353 59 972 7119			●	●	●	●	●									Up to £6,000,000
Newbridge Engineering Ltd	01429 866722			●	●	●	●								●	✓	Up to £1,400,000
Newton Fabrications Ltd	01292 269135			●	●	●				●	●	●			●	✓	Up to £4,000,000
Nusteel Structures Ltd	01303 268112						●	●	●	●						✓	Up to £4,000,000
On Site Services (Gravesend) Ltd	01474 321552				●		●	●		●	●				●		Up to £400,000
Overdale Construction Services Ltd	01656 729229			●	●		●	●			●				●		Up to £1,400,000
Paddy Wall & Sons	00 353 51 420 515			●	●	●	●	●	●	●	●					✓	Up to £6,000,000
Pencro Structural Engineering Ltd	028 9335 2886			●	●		●	●			●				●	✓	Up to £2,000,000
Peter Marshall (Fire Escapes) Ltd	0113 307 6730									●					●		Up to £1,400,000
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●		Up to £1,400,000
REIDsteel	01202 483333		●	●	●	●	●	●	●	●	●	●		●			Up to £6,000,000*
Remnant Engineering Ltd	01564 841160				●		●	●		●					●	✓	Up to £400,000*
Rippin Ltd	01383 518610			●	●	●	●	●									Up to £2,000,000
Robinson	01332 574711		●	●	●	●	●		●	●	●	●		●	●	✓	Above £6,000,000
Rowecord Engineering Ltd	01633 250511	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✓	Above £6,000,000
Rowen Structures Ltd	01773 860086		●	●	●	●	●	●	●	●	●	●		●			Above £6,000,000*
RSL (South West) Ltd	01460 67373			●	●		●				●						Up to £1,400,000
S H Structures Ltd	01977 681931						●	●	●	●							Up to £3,000,000
Severfield-Reeve Structures Ltd	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●		✓	Above £6,000,000
Shipley Fabrications Ltd	01400 231115			●	●	●	●		●	●	●				●		Up to £200,000
SIAC Butlers Steel Ltd	00 353 57 862 3305		●	●	●	●	●	●	●		●	●				✓	Above £6,000,000
SIAC Tetbury Steel Ltd	01666 502792			●	●	●	●				●	●				✓	Up to £3,000,000
Snashall Steel Fabrications Co Ltd	01300 345588			●	●		●								●		Up to £2,000,000
South Durham Structures Ltd	01388 777350			●	●	●				●	●	●			●		Up to £800,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●				●	●			●		Up to £400,000
Terence McCormack Ltd	028 3026 2261			●	●		●	●									Up to £800,000
The AA Group Ltd	01695 50123			●	●	●	●			●	●				●		Up to £4,000,000
Traditional Structures Ltd	01922 414172		●	●	●	●	●	●	●		●	●		●		✓	Up to £4,000,000*
W & H Steel & Roofing Systems Ltd	00 353 56 444 1855			●	●	●	●	●						●	●		Up to £4,000,000
W I G Engineering Ltd	01869 320515				●					●					●		Up to £400,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✓	Up to £6,000,000
Watson Steel Structures Ltd	01204 699999	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000
Westbury Park Engineering Ltd	01373 825500	●			●			●	●	●	●				●	✓	Up to £800,000
William Haley Engineering Ltd	01278 760591			●	●	●			●	●	●					✓	Up to £2,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000

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

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

Company name	Tel	1	2	3	4	5	6	7	8	9
AceCad Software Ltd	01332 545800		●							
Advanced Steel Services Ltd	01772 259822								●	
Albion Sections Ltd	0121 553 1877	●								
Andrews Fasteners Ltd	0113 246 9992									●
ArcelorMittal Distribution – Bristol	01454 311442								●	
ArcelorMittal Distribution – Mid Glamorgan	01443 812181								●	
ArcelorMittal Distribution – Birkenhead	0151 647 4221								●	
ArcelorMittal Distribution – Scunthorpe	01724 810810								●	
Arro-Cad Ltd	01283 558206			●						
ASD metal services - Biddulph	01782 515152								●	
ASD metal services – Bodmin	01208 77066								●	
ASD metal services - Cardiff	029 2046 0622								●	
ASD metal services - Carlisle	01228 674766								●	
ASD metal services - Daventry	01327 876021								●	
ASD metal services - Durham	0191 492 2322								●	
ASD metal services - Edinburgh	0131 459 3200								●	
ASD metal services - Exeter	01395 233366								●	
ASD metal services - Grimsby	01472 353851								●	
ASD metal services - Hull	01482 633360								●	
ASD metal services – London	020 7476 0444								●	
ASD metal services - Norfolk	01553 761431								●	
ASD metal services - Stalbridge	01963 362646								●	
ASD metal services - Tividale	0121 520 1231								●	
Austin Trumanns Steel Ltd	0161 866 0266								●	
Ayrshire Metal Products (Daventry) Ltd	01327 300990	●								
BAPP Group Ltd	01226 383824									●
Barnshaw Plate Bending Centre Ltd	0161 320 9696	●								
Barrett Steel Services Ltd	01274 682281								●	
Bentley Systems (UK) Ltd	0141 353 5168		●							
Cellbeam Ltd	01937 840600	●								
Cellshield Ltd	01937 840600							●		
CMC (UK) Ltd	029 2089 5260							●		
Composite Metal Flooring Ltd	01495 761080	●								
Composite Profiles UK Ltd	01202 659237	●								
Computer Services Consultants (UK) Ltd	0113 239 3000		●							
Cooper & Turner Ltd	0114 256 0057									●
Corus	01724 404040				●					
Corus Ireland Service Centre	028 9266 0747								●	
Corus Panels & Profiles	01684 856600	●								
Corus Service Centre Dublin	00 353 1 405 0300								●	
Corus Tubes	01536 402121				●					
Corus Wednesfield	01902 484100								●	
Daver Steels Ltd	0114 261 1999	●								
Development Design Detailing Services Ltd	01204 396606			●						
Easi-edge Ltd	01777 870901							●		
Fabsec Ltd	0845 094 2530	●								
Ficep (UK) Ltd	01924 223530					●				
FLI Structures	01452 722200	●								
Forward Protective Coatings Ltd	01623 748323						●			
GWS Engineering & Industrial Supplies Ltd	00 353 21 4875 878									●
Hempel UK Ltd	01633 874024						●			
Hi-Span Ltd	01953 603081	●								
Hilti (GB) Ltd	0800 886100									●
International Paint Ltd	0191 469 6111						●			
Interpipe UK Ltd	0845 226 7007								●	
Jack Tighe Ltd	01302 880360						●			
Kaltenbach Ltd	01234 213201					●				
Kingspan Structural Products	01944 712000	●								
LaserTUBE Cutting	0121 601 5000								●	
Leighs Paints	01204 521771						●			
Lindapter International	01274 521444									●
Metsec plc	0121 601 6000	●								
MSW Structural Floor Systems	0115 946 2316	●								
National Tube Stockholders Ltd	01845 577440								●	
Northern Steel Decking Ltd	01909 550054	●								
Northern Steel Decking Scotland Ltd	01505 328830	●								
John Parker & Sons Ltd	01227 783200								●	●
Peddinghaus Corporation UK Ltd	01952 200377					●				
Peddinghaus Corporation UK Ltd	00 353 87 2577 884					●				
PMR Fixers	01335 347629	●								
PP Protube Ltd	01744 818992	●								
PPG Performance Coatings UK Ltd	01773 837300						●			
Prodeck-Fixing Ltd	01278 780586	●								
Profast (Group) Ltd	00 353 1 456 6666									●
Rainham Steel Co Ltd	01708 522311								●	
Richard Lees Steel Decking Ltd	01335 300999	●								
Rösler UK	0151 482 0444					●				
Schöck Ltd	0845 241 3390	●								
Site Coat Services Ltd	01476 577473						●			
Steel Projects UK Ltd	0113 253 2171		●							
Steelstock (Burton-on-Trent) Ltd	01283 226161								●	
Structural Metal Decks Ltd	01202 718898	●								
Structural Sections Ltd	0121 555 1342	●								
Studwelders Ltd	01291 626048	●								
Tekla (UK) Ltd	0113 307 1200		●							
Tension Control Bolts Ltd	01948 667700									●
Voortman UK Ltd	01827 63300					●				
Wedge Group Galvanizing Ltd	01909 486384						●			

Company name Tel 1 2 3 4 5 6 7 8 9
Company name Tel 1 2 3 4 5 6 7 8 9

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
Griffiths & Armour	0151 236 5656
Roger Pope Associates	01752 263636
Highways Agency	08457 504030

Steelwork contractors for bridgework

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
- **QM** Quality management certification to ISO 9001

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	FG	PG	TW	BA	CM	MB	RF	QM	Contract Value (1)
'N' Class Fabrication & Installation	01733 558989	●	●	●	●			●	✓	Up to £800,000
Andrew Mannion Structural Engineers Ltd*	00 353 90 644 8300	●	●	●	●				✓	Up to £3,000,000
Briton Fabricators Ltd*	0115 963 2901	●	●	●	●	●	●	●	✓	Up to £3,000,000
Cimolai Spa	01223 350876	●	●	●	●	●	●		✓	Above £6,000,000
Cleveland Bridge UK Ltd*	01325 502277	●	●	●	●	●	●	●	✓	Above £6,000,000*
Concrete & Timber Services Ltd	01484 606416	●	●	●		●	●		✓	Up to £800,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456	●	●	●	●	●		●	✓	Up to £6,000,000
Interserve Project Services Ltd	0121 344 4888							●	✓	Above £6,000,000
Interserve Project Services Ltd	020 8311 5500	●	●	●	●		●	●	✓	Up to £400,000*
Mabey Bridge Ltd*	01291 623801	●	●	●	●	●	●	●	✓	Above £6,000,000
Nusteel Structures Ltd*	01303 268112	●	●	●	●	●		●	✓	Up to £4,000,000
P C Richardson & Co (Middlesbrough) Ltd	01642 714791	●						●	✓	Up to £3,000,000*
Remnant Engineering Ltd*	01564 841160	●							✓	Up to £400,000*
Rowecord Engineering Ltd*	01633 250511	●	●	●	●	●	●	●	✓	Above £6,000,000
SIAC Butlers Steel Ltd*	00 353 57 862 3305	●	●	●	●	●		●	✓	Above £6,000,000
TEMA Engineering Ltd	029 2034 4556	●	●	●	●	●	●	●	✓	Up to £1,400,000*
Varley & Gulliver Ltd*	0121 773 2441	●						●	✓	Up to £4,000,000
Watson Steel Structures Ltd*	01204 699999	●	●	●	●	●	●	●	✓	Above £6,000,000

* Denotes membership of the BCSA