NOVEMBER/DECEMBER 2009 VOL17 NO10

# NSC

NEW STEEL CONSTRUCTION

www.new-steel-construction.com

Motorways missing link
New stand at Headingley
Regenerating Ravenscraig
Safety first at school for blind

# To stay ahead, it's necessary to change...


## ... with over 100 different models that will significantly reduce production costs and increase productivity, FICEP undoubtedly have some of the most cost-efficient CNC steel processing machines in this day and age

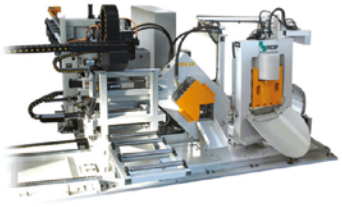
With over 100 automated steel processing machines that can be used as highly efficient stand-alone performers or integrated into a complete, state-of-the-art software controlled production line, FICEP is helping more and more companies to become far more competitive in today's difficult trading conditions.

The productivity increases and reductions in production costs that are achievable are unprecedented within the structural steel and fabrication industry.

Many of these advanced FICEP CNC machines now also incorporate a unique patented, scribing system which interfaces directly with CAD systems without operator input, providing further substantial savings in time and labour costs. This proven system is being used successfully in large and small structural steel fabricators to maximise competiveness and productivity.

To find out more about how these state-of-the-art machines can benefit your company, contact FICEP's new UK Headquarters, Technology and Service Centre -

**AUTOMATIC DRILLING, THERMAL CUTTING & SCRIBING OF PLATES**



**DRILLING, CUTTING & SCRIBING OF BEAMS ( with Band Saw, Disc Saw or Coping System options )**

**DRILLING, PUNCHING, THERMAL CUTTING, MILLING & SCRIBING OF HEAVY PLATES**

FICEP UK Ltd., 3 Gilcar Way, Valencia Park, Wakefield Europort, Normanton WF10 5QS

Sales Tel: **+44 (0) 1924 223530** Fax: **+44 (0) 1924 223666**

E-mail: **info@ficep.co.uk** **www.ficep.co.uk**

FICEP UK LTD

CAM SOFTWARE/DRILLING/CUTTING/PUNCHING/MILLING/ SCRIBING/SHOT BLASTING/PRESS BRAKES/PIPE CUTTING/LIFTING

ASK ABOUT THE LATEST COST-EFFECTIVE **PART EXCHANGE** AND **LEASING DEALS** ON OFFER

# CONTENTS

NOVEMBER/DECEMBER 2009 VOL 17 NO 10

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


**5** **Editor's comment** Steel will retain its competitive advantage once the recession is over, writes Editor Nick Barrett.

**6** **News** The £1M Target Zero has been running for just over one year and has resulted in the development of three internal publications.

**12** **Profile** Jack Sanderson has taken over as BCSA President at one of the most challenging periods in the association's history.

**14** The **Steel Industry Guidance Notes (SIGNS)** - giving practical advice on technical, commercial, legal, and health and safety issues - have been distributed with NSC for four years.

**16** A new stand at **Headingley cricket ground** will open next year and will be utilised as teaching space outside of the cricket season.

**18** The regeneration of the former steelworks site at **Ravenscraig** is continuing with the construction of a new sports centre complete with a full size indoor football pitch.

**22** **Glasgow**'s missing motorway link is being completed with the aid of four steel bridges, the first of which has been erected across the M8.

**24** Nick Barrett reports from a seminar where a clear vision was set out for the future of **sustainable steel construction**.

**26** The **Royal National Institute of Blind People**'s new School and Children's Home in Coventry will make a huge impact on the local economy and community.

**28** SCI's David Brown explains how designers can apply the Eurocode rules to assess **second-order effects in portal frames**.

**32** **40 Years Ago** Our look back through the pages of Building with Steel features the Erskine Bridge.

**34** **20 Years Ago** Drawn from the pages of Steel Construction, our featured topic is London's Broadgate development phases 1 to 4.

**36** **Advisory Desk** The latest advice from SCI - AD339 - is guidance on stainless steel in contact with other metals.

**36** **Codes and Standards**

**39** **Publications**

**40** **BCSA members**

**43** **Register of Qualified Steelwork Contractors**


**Cover Image**
**M74 Completion Project, Glasgow**
Main clients: Transport Scotland, Glasgow City Council, South Lanarkshire Council, Renfrewshire Council
Structural engineers: Jacobs/ Atkins JV
Steelwork contractor: Cleveland Bridge
Steel tonnage: 19,000t

# Cure the pain of a **tender** situation

How can Clients, Designers and Principal Contractors ensure that steelwork is done safely in accordance with the CDM Regulations?

The answer is to rely on the British Constructional Steelwork Association (BCSA) or The Register of Qualified Steelwork Contractors for Bridgeworks (RQSC), as experienced assessors have visited the companies and assessed their competence based on track record, personnel and resources.

There is no easier way of prequalifying companies than using the membership list of the BCSA or RQSC.

Select a steelwork contractor who has the special skills to suit your project.


Visit **www.steelconstruction.org**
**to find a steelwork contractor or a supplier of products and services for your next project.**

**The British Constructional Steelwork Association Ltd and**
**The Register of Qualified Steelwork Contractors for Bridgeworks**
4 Whitehall Court, Westminster, London SW1A 2ES • Tel: 020 7839 8566 • Fax: 020 7976 1634
Email: postroom@steelconstruction.org • Website: www.steelconstruction.org

NSC NEW STEEL CONSTRUCTION
www.new-steel-construction.com

**EDITOR**
**Nick Barrett** Tel: 01323 422483
nick@new-steel-construction.com
**DEPUTY EDITOR**
**Martin Cooper** Tel: 01892 538191
martin@new-steel-construction.com
**CONTRIBUTING EDITOR**
**Ty Byrd** Tel: 01892 524455
ty@barrett-byrd.com
**PRODUCTION EDITOR**
**Andrew Pilcher** Tel: 01892 524481
andrew@new-steel-construction.com
**PRODUCTION ASSISTANT**
**Alastair Lloyd** Tel: 01892 524536
alastair@barrett-byrd.com
**NEWS REPORTERS**
**Mike Walter, Victoria Millins**
**ADVERTISING SALES MANAGER**
**Sally Devine** Tel: 01474 833871
sally@new-steel-construction.com

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

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

**Corus**
PO Box 1, Brigg Road, Scunthorpe, North Lincolnshire DN16 1BP
**Telephone** 01724 405060 **Fax** 01724 404224
**Website** www.corusconstruction.com
**Email** construction@corusgroup.com

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



**CHANGES TO THE MAILING LIST**
If you wish to notify us of a change:
**Non Members** Non Members of either the SCI or the BCSA please telephone Corus on 01709 825452
**Members BCSA** Telephone BCSA on 020 7839 8566
**Members SCI** Telephone SCI on 01344 636525



corus BCSA The British Constructional Steelwork Association Ltd SCI

# Steel still the competitive choice

Hopefully, October's report of an unexpected continued fall in UK economic output will be looked back on as the nadir of this great credit crunch related recession. Things should start getting better from around about here, economists seem to agree, and all industrial sectors are hoping for better things for 2010.

The construction sector however looks like lagging behind others as it usually does when we come out of recession, and there are genuine fears that the economic turnaround will come too late for some. Steelwork contractors have been under sustained pressure during 2009 and see little immediate cause for cheer going into 2010. During the last recession some 25% of steelwork contractors were driven out of business by the collapse in orders and margins. Are we going to see that happen again?

It could be as bad as that, but there are reasons for greater optimism this time around. Hard lessons were learned in the last recession and the survivors emerged determined to remain on a sounder commercial footing in future. Part of that strategy involved not incurring too much debt that could only be paid back if the good times continued to roll. Another was not to chase workload to commercially suicidal levels if and when prices started to fall.

The big question is whether commercial discipline has held in the face of the immense pressures of the past year or so. There have been some reports of steelwork contractors taking work at below cost. Clearly this, if true, is not sustainable. Some balance sheets can take the strain for a limited period to keep workforces intact, but reality will eventually catch up.

Some steelwork contractors have preferred to mothball plant rather than accept the uneconomic prices being sought in the market. Main contractors have demanded the best – lowest - price that they can find. Placing of orders has been put off in the expectation that a cheaper price would be available next week. All that is about to change.

At the end of the last recession, prices started to rise at a speed that took many by surprise. Stockpiles of steel have now been run down and can be expected to be built up again. World demand for steel, not only for construction uses, is forecast to rise significantly next year and world prices are already rising. Main contractors risk being overtaken by events if they keep delaying placing orders.

The UK steel construction industry is the best in the world and that is not going to change despite the pressures of recession. There may be a few absent names from tender lists in future, but the choice of steelwork contractors will still be a lot wider than that for any other material. After the recession it can confidently be promised that steel will still retain its competitive advantages.

***Nick Barrett - Editor***

# Target Zero up and running

Low and zero carbon steel intensive buildings will soon be a reality due to Target Zero, a £1M project jointly funded by the BCSA and Corus.

"It has been running for over a year and has made significant progress towards developing practical guidance for low and zero carbon buildings," said Dr David Moore, BCSA Director of Engineering.

The project team, which is led by AECOM with support from cost consultant Cyril Sweett, the Swindon Technology Centre and SCI, have been investigating low and zero carbon options for five building types: schools; warehouses; supermarkets; medium-rise buildings, and mixed-use developments.

The work on schools is almost complete and has resulted in the development of three internal publications: *Zero Carbon Schools - Technical Guide 1 A route to Zero Carbon; Zero Carbon Schools - Technical Guide 2 A route to BREEAM 'Outstanding',* and *Zero Carbon Schools - Technical Guide 3 Reducing embodied energy.*

The work on warehouses is also progressing and two internal reports have been developed and are currently being reviewed by the Target Zero technical committee.

A team comprising the SCI and AECOM have been commissioned to produce a guidance document for each of the five types of structure. These publications are aimed at engineers and architects and will be approximately 40 pages long and written in an easy to read rather than a technical style.

The first publication is expected before the end of this year with the remaining documents delivered during 2010.

For more information on Target Zero and to register for its regular newsletter visit: *www.targetzero.info*

# London 2012 Velodrome is racing ahead

Construction work on the London 2012 Olympic Velodrome is speedily progressing with steelwork now visible above the structure's base.

The 6,000 seat Velodrome will host the Olympic track cycling events and its design features a lower tier of 3,500 seats and an upper tier of 2,500 seats. The two tiers will be divided by a 360 degree concourse level offering views over the Olympic Park.

Steelwork is now well underway with sections supporting the upper tier seating and the roof being lifted into place. More than 2,500 sections of steelwork will be installed by steelwork contractor Watson Steel Structures.

The steelwork will rise in height by 12m from the shallowest point to the highest part of the structure, helping form the distinct double curved structure which has been designed to reflect the geometry of the cycling track.

Olympic Delivery Authority Chief Executive David Higgins said: "The Velodrome will be another landmark venue and we can now begin to see the striking architecture take shape.

"Steel fabricated in the North West is playing an essential role in shaping the venue and demonstrates the role that companies across the UK are playing in helping deliver the infrastructure for the London 2012 Olympics."

# World's largest Audi Centre opens in London

Steel construction played a major driving role in the completion of the London Audi Centre in Brentford which officially opened in October.

The imposing new building is the largest Audi centre in the world and features five floors, with an additional two basement levels, representing a £45M investment by Audi UK.

Working on behalf of main contractor ISG Interior/Exterior, Rowen Structures erected 690t of structural steelwork for the project during a nine week programme.

One of the most striking elements of the structure is a 12 degree raking facade along its southern elevation. This was formed with a series of front plated tapered raking columns, each 22.6m long and weighing 6t.

Two cranes were required to install these raking columns; one to temporarily support the column while the other crane was used to install the restraining floor steelwork.

"The remaining perimeter columns and roof beams were pin connected to allow movement within the structure," said Jeff Matthews, Rowen Structures Project Manager. "All of these columns required temporary supports until the building was fully erected."

Architect for the project Wilkinson Eyre says its inspiration was drawn from nature, art and science to create a technologically advanced sculptural form. The elegantly sweeping curves are said to be reminiscent of a manta ray, and the aerodynamic wing shapes of a B2 Stealth Aircraft.

# Prestigious training award for Corus


Corus and Ashorne Hill Management College have won a UK National Training Award in the category of 'Collaboration and Partnerships' for their Felt Leadership Programme.

The prestigious accolade was presented at a ceremony held at the National Motorcycle Museum in the West Midlands on 1 October. Having previously scooped a Regional Training Award, receiving the national prize provides official external recognition for an exceptional training programme which has seen more than 1,800 Corus staff trained.

The Felt Leadership Programme gives employees responsibility for managing their own safety improvements by concentrating on leadership behaviours. The programme is interactive and employee driven to ensure maximum engagement.

There is evidence of the programme's success in that accidents have reached their lowest ever level across all Corus sites. Sean Lyons, Site Director at Corus Scunthorpe said: "Together, Ashorne Hill and my steelmaking team have broken significant new ground by introducing an effective means of giving employees more authority and responsibility for managing their own safety. The programme has given fresh impetus and dynamism to our ultimate goal of eliminating accidents completely."

# Open house to demonstrate new machine benefits

Kaltenbach will be hosting an open house event from 10-12 November at its Bedford headquarters to provide customers with new opportunities to combat the impact of the recession.

Simon Smith, Managing Director Kaltenbach UK said: "Our pursuit to continually develop improvements in process efficiencies are providing industry with new, innovative and highly efficient technology gains. The event will introduce some totally new machines, make available used, factory-reconditioned machines and emphasise the extent of our UK spares and support team."

New machines on show will include an MSK 471 NA circular blade saw (right) and a new generation of Behringer HBV bandsaws which will be making their UK debuts.

On exhibit will be a large range of Kaltenbach and Behringer semi and fully automatic saws, for billet cutting to metal fabrication, for stockholders and engineering workshops, processing exotics, ferrous and non ferrous metals.

The event is free, but registration must be made in advance via Kaltenbach's office, Tel: 01234 213201 or email *marketing@kaltenbach.co.uk*


# Full steam ahead for Blackfriars revamp

Bourne Special Projects is helping deliver Network Rail's landmark redevelopment of London Blackfriars rail station by undertaking important enabling work.

The company, working alongside Balfour Beatty Civil Engineering, has provided temporary access routes into the station and installed a footbridge between platform four and five. Bourne Special Projects will also fit covered walkways inside the station next year.

"As the station is to remain open throughout the project our contract has been to provide temporary works so passengers can be rerouted around the construction site," explained Ivor Robinson, Bourne's Project Manager.

The redevelopment of Blackfriars station is part of the £5.5bn congestion-busting Thameslink Programme. The station will be completely redeveloped, with construction taking place on both banks of the River Thames plus extensive work on Blackfriars Rail Bridge.

The new Blackfriars rail station will be the only station in the UK to span a river. It will feature a new station on the South Bank, the first built in this location for over 120 years, and it will give passengers direct access to key local attractions such as the Tate Modern.

Due for completion in early 2012, Blackfriars rail station will be equipped to handle 12 car trains for the first time and significantly more trains will stop at the station every hour. The Underground station will also be considerably enhanced.

AROUND THE PRESS

***The Times***
*20 October 2009*
**Building from the heart**
Inside (Richard) Rogers says, "we went rather Japanese". It's essentially a traditional Japanese wooden-framed post and beam villa, topped with a floating roof -albeit in steel - dotted with intimate spaces and hidden courtyard gardens.

***New Civil Engineer***
*8 October 2009*
**Luck of the Irish**
(Dublin's Aviva stadium) The complex steel roof structure is critical to the stadium's elegant, sweeping form. But this elegance was aided by the fact that there was no demand for the roof to be fully enclosed - this allowed designers to minimise coverage, with the knock-on effect of reducing loadings and keeping truss dimensions minimal.

***Construction News***
*1 October 2009*
**Diversifying into a nuclear powered future**
We can do the steel frame but we can also do the floors, curtain walling and fire protection. The trend with main contractors is to move towards being project managers and reduce the number of packages on a project.

***Building Magazine***
*18 September 2009*
**This is the BBC**
Each secondary steel box sits on big acoustic dampers, a studio for the BBC Philharmonic Orchestra sits on hydraulic jacks, to ensure no noise can penetrate from adjoining studios.

***Building Magazine***
*25 September 2009*
**Get your skates on**
Rather than using glulam beams to span the complete distance, it introduced a single 64m-long steel arch connected by pin joints to buttresses at the north and south ends of the ice rink.

**Contract Journal**
*7 October 2009*
**Steel spotlight**
Work continues on the steel supports for the main floodlights at the Olympic Stadium in Stratford. Elsewhere on the site, the main land bridge, which is 250m long and 40m wide and made from 1,700t of steel, has been lifted into place.

# Forum on CE Marking held in London

In order to discuss CE Marking requirements for fabricated steelwork the BCSA hosted a European Convention for Constructional Steelwork (ECCS) workshop in London on 29 September.

The workshop, which was attended by 30 people from ten European countries, also discussed the views from other member states on both the interpretation of the recommendations in EN 1090-1 (CE Marking standard) and the implementation of CE Marking.

At the workshop presentations were given by Dr David Moore, BCSA Director of Engineering, on the Construction Products Directive and the regulatory background; Dr Roger Pope, BCSA Consultant, on the basis of CE Marking in EN 1090-1 and EN 1090-1; and Jeff Garner, BCSA Welding and Fabrication Manager, on welding quality management requirements.

For further information on CE Marking of structural steelwork refer to the BCSA publication No.46/08 *'Guide to the CE Marking of Structural Steelwork'*.

## New HQ for machinery manufacturer

FICEP UK has moved into a new 1,672m² purpose built headquarters, demonstration showroom and warehouse facility at Wakefield's Europort business park near Junction 31 of the M62.

The premises will be used to both showcase and prepare the company's CNC machines for distribution to its customers nationwide. It is now FICEP's UK base for its customer sales and support, servicing, maintenance and parts stockholding operations.

Mark Jones, FICEP UK Managing Director said: "The site is the ideal location for our national headquarters and will offer excellent communications within Yorkshire and to the rest of the UK."

## Arts college styled with steel


Kingswood School in Corby, Northamptonshire is being rebuilt with the aid of 500t of structural steelwork supplied by Caunton Engineering on a design and build basis.

The new two and three storey school will eventually cater for 1,200 pupils and is being built adjacent to the existing school and also on the site of the former Our Lady and Pope John School which was recently demolished.

The existing Kingswood School is a highly regarded arts college and the new facilities will include speciality drama rooms, which will consist of a theatre and an outdoor amphitheatre, a recording studio, rehearsal rooms and a dance studio.

One of the main features of the school will be a large atrium roofed with ETFE. Caunton's Marketing Director Geoffrey Taylor said: "ETFE has life-span said to be 25 years, after which it can be replaced in a process that promises to be much easier than conventional re-roofing. It is lightweight compared with conventional roofing materials, and so attractive too it helps to embellish the steel framework which thanks to creative architecture is already very striking."

Main contractor for the project is Interserve and the school is on course to open in September 2010.

# BCSA publishes welding guide

BCSA has recently published a book of typical Welding Procedure Specifications for use in structural steelwork using the Metal-arc Active Gas (MAG) process.

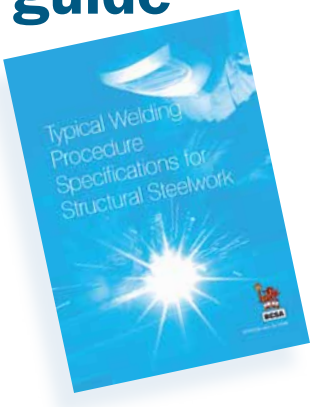
Written by a group of welding engineers and industry experts the publication is aimed at simplifying and standardising welding procedures used in structural steelwork.

While the book is intended for use by all those actively involved in welding and welding technology it is primarily aimed at providing a framework for steelwork contractors to develop and qualify rationalised welding procedures, appropriate to their range of activities.

The book outlines the most common weld joint types, in material grades up to and including BS EN 10025 - S355J2, and details the route to qualifying them in accordance in accordance with the current European Standard BS EN ISO 15614-1.

The book contains 14 preliminary Welding Procedure Specifications (pWPS) that may be used to support the qualification of a range of partially completed Welding Procedure Specifications also contained in the book.

To assist the user weld joint types are placed in categories from 1 to 5 where in general terms, the higher the category number, the more difficult the joint type is to produce. A steelwork contractor would review the weld joint types he most commonly uses, identify the appropriate category, carry out welding qualification tests based on the identified pWPS and then complete the Welding Procedure Specifications linked to that category.




The book is published by the BCSA and can be ordered from the BCSA website or by calling BCSA Publications on 0207 7839 8566. The book is priced at £40 incl p&p.

## Pilot bolting coordinator course a success

Photo courtesy of TCB

The BCSA held a pilot Level 3 Bolting Coordinator course on 14 October at the Mabey Bridge (formerly Fairfield Mabey) facility in Chepstow.

The course, which is aimed at the installation of preloaded bolts in bridges, consisted of a series of lectures on bolting, TCB's and the installation and inspection methods given in the new European fabrication standards - BS EN 1090-2.

Other parts of the pilot course, overseen by the Highways Agency, included a multiple choice assessment and the assembly of a practical connection by candidates chosen from Mabey Bridge and Rowecord Engineering.

"A Bolting Coordinator is a requirement of the National Highways Sector Scheme 20 and following the success of the pilot course it will now be rolled out to all members of the RQSC," said Dr David Moore, BCSA Director of Engineering.

## Steel to fly high on new Seagull's home

Located at Falmer on the outskirts of Brighton, the new 22,500 seat capacity stadium for Brighton & Hove Albion Football Club is rapidly taking shape and will be ready in time for the 2011-12 season.

Steelwork is currently being erected by Watson Steel Structures for the stadium's east and south stands. During December a 170m-long arch truss will be erected enabling the roof of the east stand to be completed.

This truss will be delivered to site 'piece small', assembled on the pitch and then erected in three sections. It will be installed onto a pair of 20m high temporary trestles positioned on the stand's terracing, together with heavily reinforced permanent thrust walls at each end of the truss.

While the roof truss remains on its temporary supports Watson Steel will infill the roof's front and rear steelwork along with the underslung lighting gantries.

Next year work will begin on the north stand and the main west stand. However, prior to the construction of the west stand, main contractor Buckingham must demolish some old university buildings and excavate and remove a large chalk hill.

Another similar arch roof truss will span the west stand, although this truss will support a larger roof area. Temporary works along the east stand are only scheduled to be removed once the stadium's entire roof has been erected in May 2010.

## NEWS IN BRIEF

A new free USA guide entitled **'Seismic Design of Steel Special Moment Frames'** can be downloaded from: *www.nehrp.gov/pdf/nistgcr9-917-3.pdf*

A commemorative book documenting the visionary and varied responses to the Living Steel's International Architecture Competitions will be available from November. ***Houses of Steel*** features 48 unique award winning designs for sustainable steel homes, including single and multi-storey residential projects. For more information visit: *www.livingsteel.org*

A new **Specialist Apprenticeship Scheme Pilot** commenced in October at the National Construction College at the Royal Docks Campus in East London. The apprenticeship programme enjoys the support of Metsec. The Apprenticeship Frame work consists of assessment of the NVQ at level 2, the completion of Key Skills at Level 1, and around 30 days of off the job training over a two year period of attachment to the Programme. The course will also include up to two days of manufacturer based training. Progression will be via the NVQ level 3 in Occupational Work Supervision for those people who wish to achieve a supervisory qualification. For further details of the Pilot Scheme, please contact Doreen Henry at the FPDC on 0207 6349 480 or Bill Brown at ConstructionSkills on 0784 3343 636 or by email on *bill.brown@cskills.org*

Following on from a recent meeting of the structural steel fasteners group, work has begun on **National Highways Sector Scheme 3 for bolt distributors**.

# Steel dives in for new pool and diving facility

Work is progressing on schedule for a new steel framed swimming pool and diving facility for Southend-on-Sea Borough Council.

Replacing an ageing swim centre in the town centre, the new facility is being built at Garon Park and will be linked into the existing Southend Leisure and Tennis Centre.

Working on behalf of main contractor ISG Jackson, steelwork contractor DA Green & Sons is more than halfway through its steel erection programme. To keep the overall construction on schedule the steel frame for the building is being erected prior to the excavation of the swimming and diving pools.

The facility will include a 25m, eight lane competition pool and an international standard diving pool. A smaller leisure pool and dry diving training area with specialist harnesses and trampolines is also being erected.

Due for completion by Summer 2010, the facility has already been selected as a pre games training camp for the London 2012 Olympic Games

# Eight steel bridges for new road to Bedford

Because of increased traffic volumes the existing A421 between the M1 and Bedford's southern bypass is being upgraded with the construction of a completely new dual carriageway, which will run slightly north of the old single carriageway highway.

The new highway will be 13km long and includes a number of bridges, eight of which are to be built with steel. The smallest structure is a warrren truss footbridge to be erected by Nusteel Structures, while the other seven road bridges are being fabricated and erected by Mabey Bridge (formerly Fairfield Mabey).

As of the end of October Mabey Bridge had erected four bridges, including the largest structure on the project, the Brogborough Bridge, which crosses the M1 motorway.

Erecting the Brogborough Bridge (pictured) required a series of partial night time closures of the M1. The bridge is 62.5m long and consists of four braced pairs of girders spaced at 3.5m centres.

The braced girders were brought to site in halves and then bolted together once erected with a splice close to the central pier.

"All of the longer span structures on the project are being built with steel," said Roy Brunsden, Project Manager for the Highways Agency. "Steel can be brought to site in large sections which means a quick and safe erection process."

## Diary

*For all Corus events visit www.corusevents.com tel: 01724 405060 email events@corusgroup.com*
*For all SCI events contact Jane Burrell tel: 01344 636500 email: education@steel-sci.com*

4 November 2009
**ISE Steel Frames & Disproportionate Collapse Rules**
Joint with ISE / London

10 November 2009
**Portal Frame Design**
Sheffield

11 & 12 November 2009
**Essential Steelwork Design (2 Day)**
Newcastle

19 November 2009
**Steel Frames & Disproportionate Collapse Rules**
Edinburgh

25 November 2009
**ISE Preparation for Eurocodes**
Joint with ISE/London

1 December 2009
**Floor Vibrations in Steel Framed Structures**
Joint with ISE/London

1 December 2009
**Stability of Steel Framed Buildings**
Milton Keynes

8 & 9 December 2009
**Essential Steelwork Design (2 Day)**
Watford

# For over 20 years, our technical publications have provided the guidance to support your work.

Experience counts so take advantage of ours: Millions of questions, thousands of research projects, hundreds of customers and a dedicated team of experts all giving individual attention to your questions about steel.

Meet us face to face or via telephone support, on our website or at the regular technical briefings, seminars and events we hold.

**For world-class technical support start here:** www.steelessentials.info

corus

BCSA

# Steel will progress despite recession

*Jack Sanderson has taken over as BCSA President at one of the most challenging periods in the association's history. He explains his forward looking and ambitious agenda to Nick Barrett.*

Steel may no longer flow in the Lanarkshire town of Coatbridge as it did when it was Scotland's industrial heartland, a steelmaking centre of world renown. But it still flows strong in the veins of Coatbridge born and raised Jack Sanderson, managing director of steelwork contractor Cairnhill Structures and recently installed President of the British Constructional Steelwork Association (BCSA).

Jack is proud to be only the fourth Scotsman to be appointed President since steelwork contractors founded the BCSA's forerunners over 100 years ago.

Jack grew up in the 'Iron Burgh', and from an early age knew he would work in the industry. They catch them young in Coatbridge – his school, Gartsherrie Academy, had a blast furnace with sparks flying from it as the school badge. Steelmaking has moved on, leaving behind a rich industrial heritage and Cairnhill Structures as one of the last companies in the town with steel industry connections.

But there is no dwelling in the past for either Cairnhill or the BCSA's President. Jack has a clear agenda for progress on several fronts during his two year tenure, and a proven determination to see things through. "The steel construction sector is facing the most difficult time for the industry for about 20 years and it is always going to be more difficult to maintain the pace of change when people's minds are focussed on more immediate issues.

"But we have to look ahead if we want to ensure that steel construction continues to enjoy the unprecedented success it has had. In particular we will maintain our focus on sustainability issues and on increasing the membership of the BCSA.

"Steel's sustainability case is surprisingly strong and great efforts are being made by our members and steel manufacturer Corus as well as others to strengthen it even further. The current Target Zero project with Corus which supports the government's drive towards zero carbon buildings is a good example. We will be working closely with Corus and our other supply chain partners to make sure that our sustainability message gets across."

*Above: The 'Egg', Renfrewshire Council's debating chamber in Paisley, erected by Cairnhill Structures*

***"I have always believed in setting ambitious goals because the higher your aim the more you achieve,"***

Helping BCSA members through the recession will be another priority. Companies in the close knit steel construction community frequently cooperate to mutual advantage by sharing work, and can advise each other on opportunities. "That is the sort of thing BCSA membership can bring, along with all the other technical, health and safety and legal back up," says Jack.

Some steelwork contractors stubbornly remain outside the BCSA umbrella, but Jack is keen to stress the benefits to them, and their clients, of BCSA membership. "Cairnhill Structures itself is a relatively small company but I can assure you we benefit enormously from our membership. It is the best way of showing clients that you have a sustainable approach to your business, by signing up to the association's Sustainability Charter.

"With our partners Corus and the Steel Construction Institute we have taken a lead for the sector in ensuring the smooth introduction of Eurocodes, and we have prepared the ground for the introduction of CE Marking.

"This is all invaluable work that all steel construction contractors can benefit from, but the BCSA's members will inevitably benefit the most. Staying outside the BCSA will increasingly be a difficult route to justify as regulatory and other challenges will make life more difficult. It could become a survival issue for some companies."

Jack has a good track record in convincing people that the BCSA membership is a benefit; when he became President of the BCSA's Scottish region only a few people turned up to meetings, but now they regularly attract up to 40. "That shows you how the importance of the benefits that BCSA membership confers has grown," says Jack.

Like all contractors in the construction industry, Cairnhill Structures will also need careful nurturing through what looks like being another year of subdued demand. The company, founded in 1990, occupies a 20,000 square feet workshop that was once the well known Sun Works, a former steelworks in Coatbridge. It is privately owned, part of the Watson Towers group of companies. The company turns over £8M a year, employing 50 people, and has an enviable client list including major contractors. "It is run as a family business and most of the workforce has been with us for many years," says Jack. "They are very loyal and are a big part of the reason for the company's success.

"We manage to combine traditional values of customer loyalty, quality and service with a modern business approach to performance, standards and investment policies."

Recent projects of note include the pergola at the Scottish Parliament in Edinburgh, the canopy at the Forth Bridge toll and East Renfrewshire council's headquarters in Paisley. The steelwork associated with the widening of Rosyth naval dockyard has been entrusted to Cairnhill Structures.

The company is so far the only one in Scotland to have achieved the BCSA's Gold Award under the Sustainability Charter, but Jack will be doing all he can to change that by encouraging others to go for it.

"We face a very challenging couple of years and there will be a lot of hard work. I have always believed in setting ambitious goals because the higher you aim the more you can achieve. Aim low and that is all you are likely to achieve."

The Lanarkshire steel tradition may have waned in recent years, but Jack is obviously a dedicated steward of the best of its traditions. The future might be secured as well, as Jack explains: "Neither of my two sons have followed me into the steel business but I have high hopes for my grandson Hugo Jack Sanderson." The industry will have to get along as best it can for a while though – Hugo is still only two years old. But they do catch them young in Coatbridge.

# Steel guidance; forty and counting

*The Steel Industry Guidance Notes (SIGNS), distributed with issues of NSC since January 2006, have now completed four successful years.*

SIGNS are short, two page inserts that give practical advice on technical, commercial, legal, marketing, and health and safety issues that build into a comprehensive set of notes on key aspects of steel construction. The audience for SIGNS includes clients, architects, M&E contractors, QS and engineers.

Each guidance note, is also carried on a number of web sites, contains practical advice on the back page making the advice easy to locate, assimilate and apply. They also contain either a contact point for further information or a list of up-to-date references where additional information can be found.

Each guidance note is periodically reviewed and updated to ensure that only the most relevant and up to date information is available.

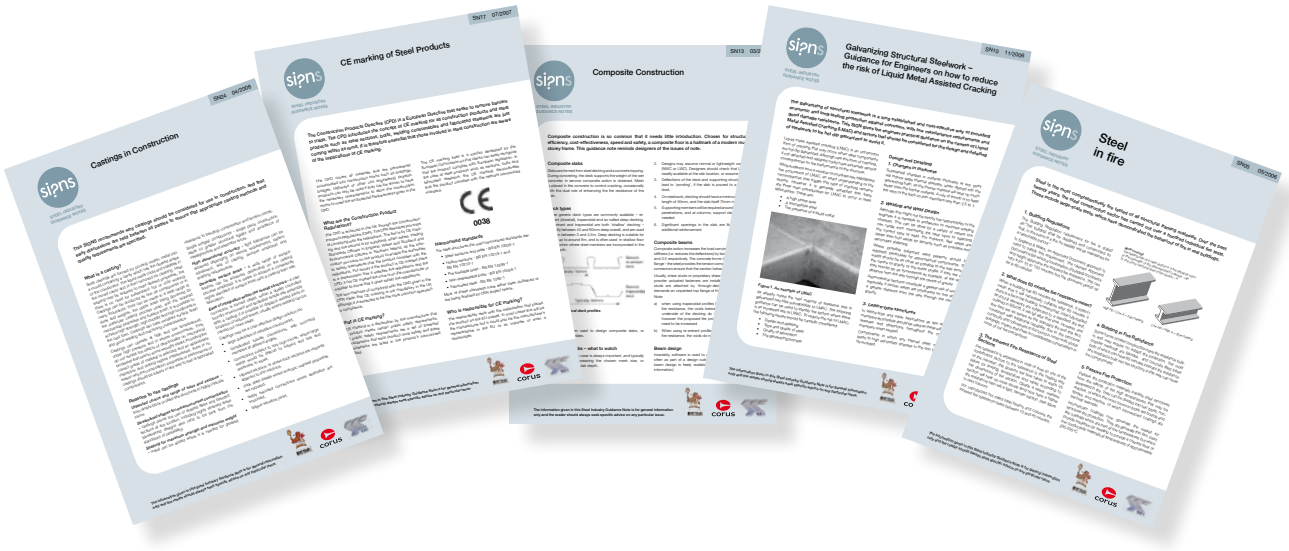
Forthcoming topics to be covered in SIGNS during 2010 will include: Assessing all structures bending, curving and cambering; envelope connections; responsible sourcing through the supply chain; welding procedures; friction grip assemblies; thermal performance; tubular joints; shallow floor solutions; correct detailing for galvanised steelwork, and adjudication.

Since January 2006 there have been 40 SIGNS:

**SN40** Corrosion protection
**SN39** Inspection documents
**SN38** Life cycle assessment of buildings
**SN37** Web openings in composite beams
**SN36** BS9999: A new approach to design of fire precautions
**SN35** Long span composite beams
**SN34** Through-thickness Properties
**SN33** Steel Industry Guidance Notes (SIGNS)
**SN32** Execution of Steel Structures
**SN31** Structural Hollow Sections - Making the correct choice
**SN30** Construction (Design & Management) Regulations and the Role of the Designer
**SN29** Sustainable Steel Construction
**SN28** Truss design
**SN27** Fracture Toughness
**SN26** European Standard for Preloadable Bolts
**SN25** Hot Rolling of Open Sections
**SN24** Castings in Construction
**SN23** Allocation of Design Responsibilities in Steel Construction
**SN22** Structural Fire Safety Engineering of Steel Structures

| | |
|---|---|
| **SN21** | Stability of Temporary Bracing |
| **SN20** | Modern standard forms of contract for modern, collaborative styles of procurement? |
| **SN19** | Intumescent Coatings |
| **SN18** | National Structural Steelwork Specification |
| **SN17** | CE marking of Steel Products |
| **SN16** | The case for steel |
| **SN15** | Design Information for Constructional Steelwork Projects |
| **SN14** | The prevention of corrosion on structural steelwork |
| **SN13** | Composite Construction |
| **SN12** | Steel Specification |
| **SN11** | Factors Influencing Steelwork Prices |
| **SN10** | Galvanizing Structural Steelwork - Guidance for Engineers on how to reduce the risk of Liquid Metal Assisted Cracking |
| **SN09** | Sustainable steel construction |
| **SN08** | Welding is a key fabrication process, yet little understood outside the workshop |
| **SN07** | Floor Vibrations |
| **SN06** | Achieiving airtightness with metal cladding systems |
| **SN05** | Steel in fire |
| **SN04** | Health and Safety on Site |
| **SN03** | Money: the most important thing |
| **SN02** | Tolerances in structural steelwork |
| **SN01** | Good Accoustic Performance |

All of the above are available for free download at the following websites:
www.new-steel-construction.com
www.steelbiz.org
www.steelconstruction.org
www.corusconstruction.com



# A dual purpose pavilion

*Next year a new pavilion will open at Headingley, the home of Yorkshire County Cricket Club. NSC reports on a stand which will also be used as teaching space by Leeds Metropolitan University outside of the cricket season.*

Anyone who watched this summer's Ashes Test between England and Australia at Headingley would have noticed the construction site along the Kirkstall Road boundary. Although partially shrouded by advertising hoardings, the beginnings of a new state of the art pavilion were clearly visible, as on the pitch the home side unfortunately toiled towards a heavy defeat.

England of course went on to win the Ashes and the Headingley match proved to be just a blip. The next time these two cricketing foes clash in the UK in 2013, the Yorkshire ground will be able to accommodate more spectators as the new 4,000m$^2$ Carnegie Pavilion will have been opened. Fans, the media and players won't have to wait that long however to enjoy the new facilities as it is scheduled to be open in time for next season's Test matches.

This five storey Pavilion, built on the site of a previous stand, will house a media box, new player facilities such as changing and treatment rooms, spectator seating over two tiers and executive boxes.

As well as providing Yorkshire County Cricket Club with upgraded facilities during the cricket season, in the off-season (or academic year) the hospitality suites and the media box will become teaching areas and a lecture theatre to be used by the client, Leeds Metropolitan University.

This dual usage of the building was one of the principle issues during the design stage and had implications particularly relevant to M&E installation and where services would be located. Another key issue was the need for long clear spans in the media/lecture theatre box.

The client has opted for a concrete framed structure, but as usually happens with sporting venues, there were several areas where structural steel was the only economical solution. "This is very much a hybrid structure," points out BAM Project Manager Simon Sutcliffe. "The undulating roof is a steel structure, while achieving the long clear spans necessary for the media box has been done with 16m-long steel beams."

The media box/lecture theatre is situated almost dead centre of the pavilion and cantilevers out from the main building. Steel beams at 3m centres form the composite roof and floor for the level above. However, another element of the media box which required a steel solution revolved around the glazing panels which wrap around the front of the box.

"Something was needed to hang the glass cladding from and the solution was a steel truss which cantilevers out by 5m and spans between the media box's two concrete walls," says John Linnell, Arup Associate.

Topping the pavilion is an eye-catching sloping and undulating roof structure clad with rainscreen cladding. The shape and the way it slopes down at one end was partially dictated by the need to preserve the sightlines of the residential properties which are situated behind the Pavilion. Interestingly, the same sightlines also played a role in the overall shape of the structure. In order not to overshadow nearby houses the building is wedge shaped and steps back by approximately 5m at every level.

The most economical way to form the roof was with a series of 14 steel trusses which vary in length, depending on the position, from 12m to 18m long. At its maximum the roof has a 5m cantilever at the front and all the trusses are 2.7m deep and will house the Pavilion's plant within their depth.

"We wanted a lightweight roof structure which would give us the clear spans for a plant area," explains Mr Linnell. "Fixing the cladding to a steel structure was also the best solution."

Elland Steel Structures are fabricating, supplying and erecting all of the steelwork for the project, as well as laying the metal decking and placing the precast terrace units. The 18m long roof trusses are the largest steel elements delivered to the site, and come fully assembled ready to be lifted immediately into place.

Although there is a small delivery yard at the site entrance along Kirkstall Lane, space is still at a premium on the site. The cricket pitch is obviously immediately in front of the Pavilion and this is strictly off limits to all construction materials.

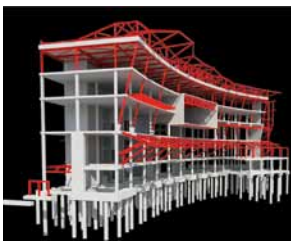
*Above: How the completed pavilion will look next year*

*Above right: Tubular steel columns were connected to the rakers and erected as one*

*Above far right: The upper tier terracing includes framed disabled areas*

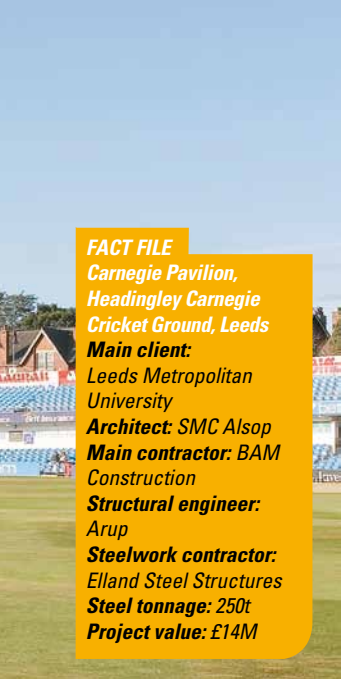
*Right: CHS sections were chosen for their aesthetic value*

***"Fixing the cladding to a steel structure was the best solution."***



*Above: Model showing the project's steelwork highlighted in red*

*Right: 16m-long steel beams provide the media box with its clear spans*



**FACT FILE**
***Carnegie Pavilion, Headingley Carnegie Cricket Ground, Leeds***
***Main client:*** *Leeds Metropolitan University*
***Architect:*** *SMC Alsop*
***Main contractor:*** *BAM Construction*
***Structural engineer:*** *Arup*
***Steelwork contractor:*** *Elland Steel Structures*
***Steel tonnage:*** *250t*
***Project value:*** *£14M*

"Bringing steel to site is a bit tricky but we've coordinated so one of the site's two tower cranes is always available to lift steel into place when it arrives," says Adrian Smith, Elland Steel's Contracts Manager. "But our main challenge has been the amount of interfaces we have with concrete, especially the rakers for the upper tier of terracing."

As with most seating areas for sporting venues, this project has used 8m-long steel rakers which support precast terracing. The rakers however are founded on a concrete floor which was cast prior to steelwork erection beginning. This meant the concrete had to be poured with the cast-in plates positioned exactly where the steel rakers would go.

Elland Steel supplied the plates with the necessary rebar and oversaw the installation. "Because of this we have a lot of on-site welding as fin plates have to be welded to the cast-in plates ready to accept the pin connected rakers," says Mr Smith.

Supporting the upper tier rakers are a series of CHS columns, chosen as they will remain in full view once the pavilion is open.

"The design and detailing of the raker connections were exacting as careful consideration of the material specification, welding procedures for on and off-site components and erection of the steelwork within demanding construction tolerances were key to a successful project," says Elland's Managing Director Mark Denham.

There are more steel to concrete interfaces on the two levels above the terracing, where the executive boxes will be positioned either side of the media box.

Some value engineering has resulted in two rows of sloping columns positioned in front of the boxes being changed from concrete to steel members. Once again the issue of accepting large glazed panels for the front of the boxes resulted in steel being chosen for its easier interfacing with cladding.

Environmental, economic and social sustainability are also central to this project. The sustainability strategy involves creating one dual-use building which will be used all year around, and is designed to achieve a BREEAM rating of 'Excellent'.

Shaun Russell of architect SMC Alsop comments: "The Carnegie Pavilion has undoubtedly been a real challenge for the client and the whole design team. We consider it to be a ground breaking project."

# Rebirth of Ravenscraig gathers pace

*Above: Trusses being erected for the hall which will house a full size football pitch*

*The former home of Scottish steel making is being transformed into the UK's first new town for more than 40 years. Martin Cooper reports on one of the first projects to get under way, an iconic steel framed sports centre.*

**FACT FILE**
***Ravenscraig Regional Sports Facility, North Lanarkshire***
***Main client:*** *North Lanarkshire Council;*
***Project manager and cost consultants:*** *Doig+Smith*
***Architect:*** *Populous*
***Main contractor:*** *Balfour Beatty*
***Structural engineer:*** *Buro Happold*
***Steelwork contractor:*** *Bone Steel*
***Steel tonnage:*** *2,300t*
***Project value:*** *£31M*

On the site where thousands of people once worked on the production steel, today a new town and community is springing up with steel again playing a pivotal role.

Known as Ravenscraig, this was previously home to Western Europe's largest hot strip steel mill and the closure of the steelworks in 1993 signalled the end of large scale steel production in Scotland.

Located on the outskirts of Motherwell, North Lanarkshire, the site covers an area of 4.5km$^2$ and has been described as one of the largest regeneration projects in Europe. A new town and community is planned which will include more than 3,000 homes, a new town centre with 84,000m$^2$ of retail and leisure space, up to 216,000m$^2$ of business and industrial space and a new transport network.

So far one major project, a new home for Motherwell College, has been completed, while a second, the Ravenscraig Regional Sports Facility, is rapidly taking shape. Bearing in mind the history of the locality, it is fitting that both of these projects have been built using structural steelwork.

Construction Work on the indoor sports centre began in early 2009 and it is progressing towards a 2010 completion date. One of the primary aims for the facility is that it will be a key training ground for Scottish sportsmen bidding to take part in the London 2012 Olympics and Glasgow's Commonwealth Games two years later.

The Ravenscraig Regional Sports Facility will be one of the largest in the UK and will include an indoor artificial football pitch, a sports hall, gymnasium, an athletics hall, as well as

*Above: Using the spine building for temporary stability, trusses are erected to form the athletics hall*

outdoor football pitches.

Housing all of these disparate indoor sports and pursuits required a unique and bold structure. Project architect Populous came up with a design which consists of three separate structures all interlinked around a fourth central spine building which houses changing rooms, offices, a cafe and the centre's main entrance.

The design uses sloping profiled cladding, which wraps around the roof in segments defined by a stepped roof profile. "Achieving the desired profile and cladding aesthetics presented challenges for the structural design," says Jeremy Morris, Structural Engineer for Buro Happold. "We worked closely with the architect, cladding subcontractor and steelwork contractor to develop the most economic solution. The cladding sheets are fixed on the skew to give the sloping appearance, the primary steelwork is located and sized for maximum efficiency, and the secondary steelwork is built out to form the cladding profiles."

Steelwork erection began with contractor Bone Steel initially erecting the two-storey spine building. This 110m-long structure is primarily beam and column, albeit with an irregular grid pattern.

The other three buildings are all portal frame structures with longitudinal bracing which abut the central 'spine'.

"We then began erecting the athletics hall," explains Jaime Greenock, Project Manager for Bone Steel. "This involved a series of 24m-long trusses which were brought to site in two pieces, bolted together and then lifted into place as one 3t section."

The form of the athletics hall was dictated by the events which it will house. The length of the building had to accommodate six 135m-long straight sprint tracks, while accommodating the pole vault meant one end of the hall's roof had to slope upwards to give extra clearance within the building.

***"The cladding sheets are fixed on the skew to give a sloping appearance…"***

The sequence of steel erection next progressed to the sports hall and gymnasium building which abuts the 'spine' along its southern elevation. This building will house nine badminton courts, pull-out seating for 450 people as well as the facility's plant room which is accommodated along one elevation on a raised mezzanine floor.

This structure is a braced framed building with a clear span roof formed with a series of 28m-long trusses. These were fabricated in two sections which were bolted together on site and then lifted into position as one piece by mobile crane.

The steel erection sequence left the largest

*The frame for the sports hall and gymnasium takes shape*

structure and the pièce de résistance of the entire project – the hall containing the full size artificial football pitch – to last. Measuring 105m long x 72m wide and 18m high at its centre, the roof is formed with steel trusses made from rolled column and angle sections. "This gives the structure an economical roof with bolted connections for easy on site assembly," says Mr Morris.

Erecting such a large structure with clear spans of 72m presented the project team with a number of logistical challenges, all associated with the erection and assembly.

The roof of the football hall incorporates a striking serrated design which will allow natural light to enter the facility all year round - which is unusual for a building with such a large enclosed area. To form this roof design which arches up in the middle and then slopes down to either end, meant all of the roof trusses are unique varying in profile from flat to arched.

*"Erecting as well as fabricating the football hall was a real challenge"*

"All of the trusses are different," says Mr Greenock. "This made fabrication challenging as not even the two trusses at either end of the building are the same, because of the roof's haunch and slopes."

The football hall was temporarily braced to the adjacent sports hall and then erected in a sequential programme away from that building in a northerly direction. The trusses are supported on D-shaped columns which were designed to give the hall the required internal headroom. The columns were erected two at a time and then supported by temporary works while a truss was lifted into place and bolted to them.

More temporary works were needed during the lifting of the trusses as they are so long. Two 18m-long 'strongbacks', produced by Bone Steel from beam sections, had to clamped to each truss during the erection process in order to guarantee rigidity.

*Above: All of the 72m-long trusses needed to be lifted by two cranes*

"Erecting as well as fabricating the football hall was a real challenge," sums up Mr Greenock. "Each truss has a different profile and the middle sections, which form the haunch, are steep making the lift a little more difficult."

As for the building's outside appearance, all the main halls have profiled metal cladding on purlins, with clear polycarbonate used for the northlights and the north elevations. The metallic exterior of the sports centre reflects the steelwork inside and will also serve as a lasting legacy on a site where steel is still playing a significant role.

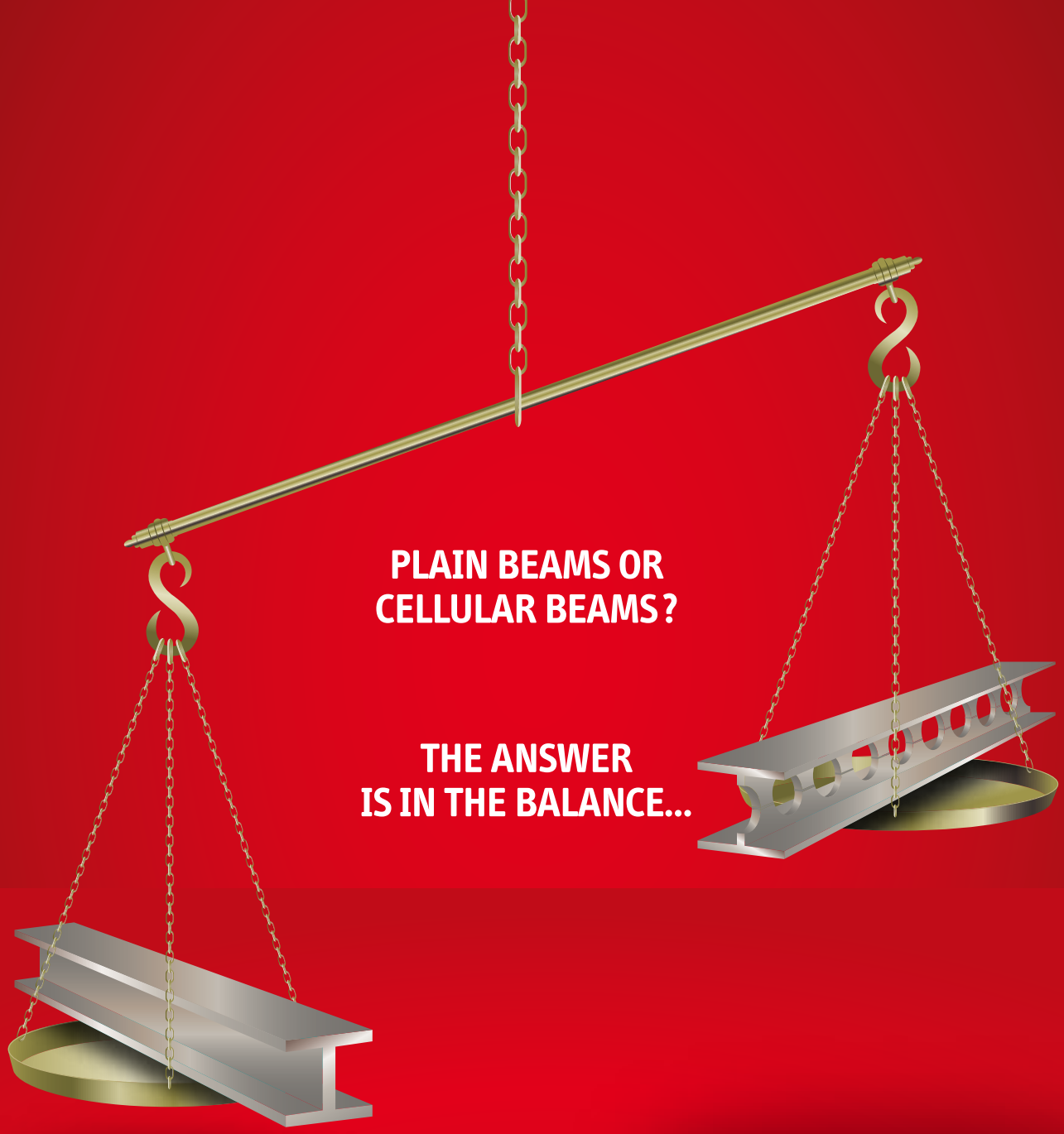
## A three day sequence

"Each truss and its two supporting columns for the football hall were erected in a three day sequence," explains Mr Greenock. "Once the initial columns were up we lifted the truss into place and braced back using hot rolled ties during the first day, then on day two we in-filled the balance of all the hot rolled steelwork, and on the third day we did all the cold rolled and erected the next two columns ready for the sequence to start again."

The sets of columns were generally released from the temporary works as the erection programme advanced and the bracing had been added. "We continually re-used about 30t of temporary steelwork on this part of the project," explains Mr Greenock.

Each of the bespoke trusses were delivered to site piecemeal and then assembled on site. Once assembled the 72m-long x 5m deep trusses weighed close to 45t each.

Bone had two crawler and two mobile cranes on the project; two mobiles working on the assembly of the trusses and two crawlers erecting the steelwork. Once assembled the two crawlers would erect each truss in a tandem lift. Then the two mobiles would infill the hot rolled tie members.



# PLAIN BEAMS OR CELLULAR BEAMS?

## THE ANSWER IS IN THE BALANCE...

Cellular Beams are up to **40% lighter** than Plain UBs and Plate Beams.

**Do I want to save cost?** ☑ **Do I want to use less resources?** ☑

Tick all your Clients' boxes.

Westok

**ASD Westok Limited, Charles Roberts Office Park, Charles Street, Horbury Junction, Wakefield, West Yorkshire WF4 5FH**
**Tel: 01924 264121 Fax: 01924 280030 Email: info@asdwestok.co.uk**

**www.asdwestok.co.uk**

ASD Westok. Part of the ASD metal services group.


# Bridging the missing link

*Glasgow's M74 Completion project includes four major steel bridges along its route. Martin Cooper reports from a motorway extension which is relying on steel for all of its long span structures.*

Just south of Glasgow city centre across the River Clyde a new five mile stretch of the M74 is being constructed. The road will not only provide a major national economic boost by completing the city's missing inner city motorway link, but also breathe new life into a previously deprived area.

Known as the M74 Completion, the new six lane motorway begins at the Fullarton Road Junction (where the M74 currently terminates) in the east of Glasgow and then continues west to link up with the M8 motorway west of the Kingston Bridge.


The project - funded by Government agency Transport Scotland with Glasgow City Council, South Lanarkshire Council and Renfrewshire Council - is part of the Scottish Government's massive infrastructure investment in Scotland's transport network which will bring new jobs to the region as well as helping with the regeneration of Glasgow, Rutherglen and Cambuslang. The M74 also plays a key role in the transport plan for Scotland's delivery of the Commonwealth Games in Glasgow 2014.

Construction work began in May 2008 and is scheduled for completion in 2011. The works contract was awarded to the Interlink M74 Joint Venture in early March 2008 for a fixed price of just under £445M.

One of the main challenges associated with the project is routing the motorway through the southern part of the city and as a consequence a number of businesses and factories have had to be relocated.

Another challenge is the number of roads and railways the route has to either go over or under. This accounts for the number of bridges - 14 in total, underpasses and deep embankments which have to be completed along the route.

"We are erecting bridges over some of Scotland's busiest roads and in the case of the West Coast Main Line, one of the UK's busiest railway

***"Our aim is not just to build and erect these bridges but to cause as little disruption to these vital transport links as possible."***

**FACT FILE**
***M74 Completion project, Glasgow***
***Main client:*** *Transport Scotland, Glasgow City Council, South Lanarkshire Council, Renfrewshire Council*
***Main contractor:*** *Interlink M74 JV, a joint venture comprising Balfour Beatty, Morgan Est, Morrison Construction, Sir Robert McAlpine*
***Structural engineer:*** *Jacobs/ Atkins JV*
***Steelwork contractor:*** *Cleveland Bridge*
***Project value:*** *£445M*
***Steel tonnage:*** *19,000t*

lines," explains Stephen Osborne, Project Manager for Cleveland Bridge. "Our aim is not just to build and erect these bridges but also cause as little disruption to these vital transport links as possible. By using steel we are able to erect the bridges, along with the necessary formwork and edge protection, overnight and quickly."

Working on behalf of the Interlink JV, Cleveland Bridge has been contracted to construct the four main bridges for the project, which consist from west to east, the 232m-long M8 Eastbound Link Bridge, the 750m-long Port Eglinton Viaduct, the 186m-long Rutherglen Station Bridge and the Auchenshuggle Bridge across the River Clyde which will be 90m long.

The first bridge to be erected along the route was the M8 Eastbound Link Bridge which went up during August. This steel composite structure will connect the M8's Eastbound carriageways to those of the M74, while a shorter Westbound Link bridge (to be completed later this year and constructed with precast concrete) will connect to the outer Westbound carriageway of the M8.

Structural engineer for the project is a Jacobs/ Atkins joint venture and it says steel was chosen for the major bridges because of economics and ease of construction. The structures span busy roads and railway lines and the client wanted to limit the time of possessions and closures. Steel bridge girders assembled off-site can be lifted into place overnight and thereby keeping disruption to the general public to a minimum.

The steelwork for the bridges is being fabricated at Cleveland Bridge's Darlington facility and delivered to site for assembly and erection. In the case of the M8 Eastbound Link Bridge steel was delivered in 20 sections, ranging in size between 16m and 34m long, and weighing between 40t and 70t. Once on site these fabricated sections were welded together, at two separate assembly yards either side of the M8, to form eight large girders weighing up to 200t each and 70m long. These main girders were then lifted two each night during four partial and full carriageway closures of the M8 motorway.

Lifting these huge steel girders into place required months of planning and required the use of the UK's largest mobile crane, a 1,200t capacity Gottwald AK-680, which needed 30 trucks to deliver it to site.

The Gottwald crane initially erected the two girders which span the existing Paisley slip road. "Although this crane has a very substantial lifting capacity the assembly area available was limited so that self-propelled modular trailers (SPMTs) were used to move the assembled sections to within pick up radius of the crane," explains Mr Osborne.

Once the first two lifts had been completed the entire crane, fully assembled with its 95m long jib, was moved by the same SPMTs to a second position on the same side of the motorway to lift the next two girders over the M8 Eastbound carriageway. The crane was then fully dismantled and moved across to the other side of the motorway to lift the final four girders over the M8 Westbound carriageway during two night time closures.

"We were delighted to reach this important milestone on the project," comments Interlink M74 JV Project Director David Welsh. "The works are already visible and these beams, which will be seen by thousands of motorists each day, emphasise the significant progress being made on this job."

Work is now progressing towards the next bridge challenge which involves the largest steel bridge structure on the route, the Port Eglinton Viaduct. This 750m long bridge consists of 14,500t of steel and spans not only the West Coast Mainline, but also the SPT Underground tunnels near West Street Station, the Paisley, and City & Union rail lines, and Eglinton Street, one of the busiest roads into Glasgow city centre.

The benefits of off-site construction are coming to the fore on this structure as the large box girders are currently being brought to site in sections and then welded together in two separate assembly yards. One for the bridge works to span the Paisley Line ,City & Union Line and SPT Underground tunnels and the other assembly yard for the larger box girders to span the West Coast Mainline.

Once again it is anticipated that rail disruption will be kept to a minimum as the Port Eglinton structure will be erected primarily during overnight rail possessions.

Also early next year steelwork will start on the Rutherglen and Auchenshuggle bridges.

*Above: The M8 Link Bridge being lifted into place with the aid of the UK's largest mobile crane*

*Below: Steel was the chosen material because of the length of spans and the need for short term possessions.*

*Below right: The large girders for the Port Eglinton Viaduct being assembled*

# Sustainable future

*The misconception that buildings must be heavy to achieve optimum thermal mass is a myth that has been laid to rest by research showing that the optimum thickness of floor slab is routinely available in almost all steel framed buildings.*

That was one of the strong messages that came across at a seminar launching the steel sector's sustainability strategy in October, where Corus and the British Constructional Steelwork Association (BCSA) set out a clear vision for the future of sustainable development using steel construction. The commitment includes a substantial programme of research and development and cooperation on a range of initiatives with industry partners, as well as support for government and construction industry sustainability objectives.

Introducing the key aims – set out in a new publication called Sustainable steel construction: Building a sustainable future - at the London

## Pioneering Charter demands support

Main contractors and clients are helping the drive towards improved sustainability by adopting a more sustainable approach to procurement. One way to do this is to support the BCSA's pioneering Sustainability Charter which commits members to high sustainability performance that is regularly assessed and monitored against 12 benchmarks.

It aims to develop steel as a sustainable form of construction in terms of economic viability, social progress and environmental responsibility – satisfying the requirements of the Triple Bottom Line.

Richard Barrett, Immediate Past President of the BCSA, (pictured) told seminar delegates: "You can help encourage sustainable procurement by including Sustainability Charter membership in your specifications which will help us as a sector to improve our own performance." This scheme was launched in 2005, the first such sustainability initiative from any representative organisation.

Delegates also heard about the success of a unique Carbon Footprint Tool that had been developed on behalf of the BCSA for steelwork contractors. It is a consistent and user-friendly tool for calculating a company's own carbon footprint as well as the embedded energy of steel products. Steelwork contractors using it can benchmark their performance, measuring improvement and producing sustainability information that can be used by customers. The BCSA uses the outputs to produce sector data and KPI's.

## New products boost for buildings

Thanks to substantial investment in research and new product development innovative products are regularly being brought to market by the steel sector that are already having positive impacts on the sustainability performance of buildings. Corus Construction Development Manager John Dowling detailed several of these at the seminar and explained why the drive towards sustainability would increasingly involve off site construction, which most steel construction is.

The Corus Photovoltaic Development for example is a £10million project to introduce Dye Sensitised Cell Technology into metal cladding for buildings, in cooperation with Australian company Dyesol and supported by the Welsh Assembly Government. Dyesol is a world leader in this technology. DSC is analogous to photosynthesis so performs better in low sunlight, poorer angles of incidence and higher temperatures than other photovoltaic technologies.

Another recent development is Bi-Steel building cores (pictured below) which are six times faster to erect than concrete cores, reducing site congestion and improving safety as there is less working at height. Another development, Hi-Point roofing, is already helping fast track building programmes, being pre assembled off site or else brought to site as a kit of parts ready for assembly and quick installation.

The future would increasingly belong to the low fault, quick and high quality solutions provided by off site steel based products and processes, Mr Dowling said.

# will be built on steel

seminar Alan Todd, Corus General Manager Construction Services and Development, (pictured, left) said: "The sector is fully committed to continuing to develop new ways of improving the sustainability performance of steel construction, and to playing a leading role in helping the industry achieve its ambitious sustainability targets.

He said: "The steel sector is united in its efforts to make steel construction even more sustainable and wholeheartedly embraces the push towards more sustainable buildings. Steel has always provided a wide range of sustainability benefits that feed through to support all aspects of the government's Triple Bottom Line, and we are confident that the time, effort and money being invested by the steel sector in improving those benefits will produce even greater sustainability benefits for society in the future."


**A new publication - *Sustainable steel construction: Building a sustainable future* – supported the event and is available from www.corusconstruction.com**

## Thermal mass myth laid to rest

BCSA consultant Roger Pope explained that the superior performance of steel as a building framing material meant that the myth of superior thermal mass performance of concrete has been laid to rest. He said:" All the thermal mass performance required can be captured by using the steel composite flooring that is typical of modern buildings. Beyond a 100mm floor there is no advantage to thermal mass."

Dr Pope focused on several technical aspects of the excellent sustainability performance of steel. Another misconception he wanted to clear up concerned the idea of specifying steel on the basis of recycled content. Steel already has very high recycling rates due to the inherent value of scrap material, so specifying recycled steel will not actually increase the amount of steel that is recycled. In fact this could have a negative sustainability impact by diverting scrap steel to products where its use was less appropriate or potentially increasing transportation.

Dr Pope argued that a fully rigorous, cradle to grave, approach that properly accounted for steels high levels of end of life recovery was needed to accurately establish the carbon emissions associated with steel use. Many of the current approaches to carbon footprinting are based on cradle to factory gate analysis due to lack of certainty on what happens to some products at the end of their life. He also pointed out that expressing figures on a per tonne basis is misleading as steel has a higher strength to weight ratio than other materials, so the embodied $CO_2$ emissions associated with a steel framed building will often be significantly less than with other framing material options. For further details see *www.corusconstruction.com/sustainability.*

## Improving design efficiency

TARGET ZERO®

David Cheshire of AECOM detailed the progress being made by the joint Corus-BCSA Target Zero project which was currently focussed on developing design guidance for sustainable schools and would be published shortly. Work had already started on warehouses, the next sector to be examined under the three year project supporting the government's drive towards zero carbon buildings. Target Zero will also produce design guidance for a supermarket, a city centre office, and a mixed use development.

Mr Cheshire explained the approach adopted by AECOM, which involved comparing the capital cost and energy savings implications of various design options. The aim is to produce fully detailed and costed solutions that meet the emissions reduction targets.

Eddie Murphy, Mott MacDonald Technical Director, presented case studies of two recent award winning steel-framed buildings that had achieved BREEAM Excellent ratings. The 17 storey, 35,000 square metres Manchester Civil Justice Centre and Vulcan House, a new headquarters for the UK Border Agency to house 1,800 staff in Sheffield.

Monitoring both buildings since they were occupied has provided much information about how the buildings are actually used by their occupants, leading to changes in control systems. Among the valuable lessons learned to inform future designs is that building users need to be able to have some measure of control over temperatures.

# Special school, special planning

Above: A steel frame has been used where long spans were a design requirement

*Explanatory CDs, bespoke hoardings and whole lot of care and attention are just some of the planning aspects required for the construction of a school and children's home for young people with sight loss.*

**FACT FILE**
***RNIB Rushton School and Children's Home, Coventry***
***Main client:*** *Royal National Institute of Blind People (RNIB)*
***Architect:*** *PRP*
***Main contractor:*** *Shepherd Construction*
***Structural engineer:*** *Shepherd Design*
***Steelwork contractor:*** *The AA Group (TAAG)*
***Steel tonnage:*** *275t*
***Project value:*** *£23M*

Two years in the planning and offering specialist education, therapies, healthcare and residential care, the Royal National Institute of Blind People's (RNIB) new Rushton School and Children's Home in Coventry will not only make a huge impact on the lives of its students and residents, but also a significant contribution to the local economy and community.

Rushton currently offers specialist education as well as residential care for young people between the ages of 11-19 who have a sight problem and additional complex needs. Because of a high demand for places, RNIB is expanding its service and once the project is open it will have 60 residential places available.

Situated on the site of the school's existing premises, the new school and home will include 10 bungalows, each with six single bedrooms, a lounge, dining room and kitchen; an administration block, a large teaching block and a water therapy centre with a swimming pool and hydrotherapy pool.

Building work kicked off with the demolition of some old school buildings, making room for the new build to begin. The remaining old school and residential buildings are spread out either side of the construction site and an access road currently splits the site in two, allowing pupils and teachers to safely negotiate between their two sites.

Constructing a school for children with diabilities ordinarily requires a lot of special planning, on this site it has been compounded by the fact that the existing school is situated right next door.

"Working next to and around a 'live' school is always a challenge, but here staff and pupils have an access route which runs straight through the middle of the site," explains Steve Strachan, Stepherd Construction Project Manager.

Shepherd has erected bespoke hoardings which don't allow any daylight to shine through from the site. As this could distress partially sighted pupils walking past, they have been placed either side of the access route. The hoardings are also free of any sharp corners allowing them to be used as a tactile route across the site.

Another example of the project's team special planning involved the steelwork contractor The AA Group (TAAG). Prior to steel erection beginning TAAG gave the school an audio presentation of a typical steel project. This allowed the pupils and staff to get to know the sounds associated with steel erection machinery so they would not be surprised or startled when building work began.

The ongoing first phase of the construction programme will see half of the bungalows built along with the administration block and the main teaching block. Once this has been completed next Summer, the school will decamp into its new buildings allow-

*Far left: The main school building features a circular admin area*

*Left: TAAG has erected much of the steelwork from within the project's footprint*

*Below: The completed project will offer 60 residential places and provide a boost to the local economy*

ing phase two to start. This will see the remainder of the old buildings demolished, the rest of the bungalows built and the water therapy centre erected.

The majority of the project's steelwork can be found within the main school building. This is a hybrid structure, comprising a two storey steel framed administrative block with traditional load-bearing masonry selected for the main teaching areas. Large clear spans required within the roof structure have also necessitated the need to adopt steel rafters in this location.

The sixth form structure, at the eastern end of the main school building, is also constructed using steelwork to form a 'north light' roof structure. A series of portal frames provide stability in a north to south direction with bracing, in addition to roof diaphragms, providing overall stability.

Several integrated single storey 'key stage' classrooms run along the northern face of the school. These too incorporate steel framing to provide stiffness to numerous large glazed facades.

***Prior to steel erection beginning TAAG gave the school an audio presentation of a typical steel project.***

"We have selected steelwork in those areas where its additional strength and stiffness have given the design team freedom to provide the open spaces and natural light for this very specialized end user" says Richard Stokes, Engineering Manager for Shepherd Construction.

Not only is the site bounded by existing school premises on three sides, it is also quite confined and this had made steel erection challenging. "The whole project team has had to sequence its work around other contractors because of the various materials," comments Phil Moran, TAAG Project Manager. "The steelwork's interfacing with masonry and other materials has meant we've had to programme our erection timetable."

For the main frames in the teaching block TAAG erected the steelwork, temporarily propped it while the masonry was installed. TAAG then returned to site to dismantle the temporary steel and erect the roof a few weeks later.

The teaching block's confined position also meant TAAG has had to erect much of the steel from within the structure's footprint, using lightweight machinery. "We are erecting the steel over a number of visits and adapting to the different areas of the site," sums up Mr Moran.

Also under construction as part of the first phase is the admin block. Secondary steelwork to the predominantly masonry two-storey structure has been erected. This includes RHS wind posts to add stability to slender walls, and a balcony on the first floor.

The second final phase of the construction work is scheduled for completion in early August 2011, when the RNIB will take over the entire remodelled site. There is currently 100 staff at the Rushton School and Children's Home and this will grow to over 300 by 2011. Most will be in the care sector and there will also be new teachers and teaching assistants creating new jobs and opportunities for the local community.

*Below: One of the project's three roof lanterns is assembled*

# Second-order effects in portal frames, to Eurocode 3

*Designers will have difficulty in applying the Eurocode rules to assess second-order effects in portal frames. David Brown, SCI Deputy Director, recommends a simple alternative.*

## Our BS 5950 Heritage

For many years, UK designers have been familiar with the assessment of second-order effects in portal frames. There used to be an *h*/1000 check; more recently, in the 2000 version, we are used to calculating $\lambda_r$ - a "required load factor". If second order effects are significant, the required load factor will be larger than 1.0 and (in elastic design) the applied loads are amplified by this factor to allow for the second order effects.

The method of assessing second order effects is to put notional horizontal forces at the column tops, and carry out an elastic analysis to calculate the horizontal deflection. In the gravity loadcase, if the deflection is less than *h*/1000, second order effects are small enough to be ignored in this case and $\lambda_r$ = 1.0

In cases with horizontal loads applied, $\lambda_r$ is calculated as follows:

$$\lambda_r = \frac{\lambda_{sc}}{\lambda_{sc} - 1} \quad \text{where} \quad \lambda_{sc} = \frac{h_i}{200\delta_i}$$

The horizontal deflection $\delta_i$ is due to the revised notional horizontal loads applied at the column tops, again calculated by an elastic analysis.

In both cases, the frame analysis is undertaken with no other loads on the frame – only the notional horizontal loads.

## BS EN 1993-1-1

Clause 5.2.1 covers "the effects of deformed geometry of the structure". These are second-order effects, also known as P-delta effects.

Clause 5.2.1(4) offers the opportunity to use a simple assessment of sensitivity to second order effects "for portal frames with shallow roof slopes and beam-and-column plane frames in buildings…" In these cases, the measure of sensitivity, $\alpha_{cr}$ may be calculated using the expression:

$$\alpha_{cr} = \left(\frac{H_{Ed}}{V_{Ed}}\right)\left(\frac{h}{\delta_{H,Ed}}\right)$$

In this expression, $H_{Ed}$ and $V_{Ed}$ concern total loads, not just the equivalent horizontal forces (analogous to the notional horizontal loads of BS 5950). $H_{Ed}$ is the value of the reaction at the bottom of the storey to the horizontal loads and $V_{Ed}$ is the total vertical load at the bottom of the storey. The expression can only be used when "the compression in the beams or rafters is not significant".

The Eurocode expects that all loads are applied when calculating $\alpha_{cr}$. For rectilinear beam and column structures, this approach is fine, because the vertical loads do not have a significant influence on the calculated horizontal displacements. However for duo-pitch portal frames, the approach is clearly flawed, as the vertical loads have a huge impact on the column-top deflections. Under the influence of a gravity load on the roof, the eaves spread considerably, as shown in Figure 1.

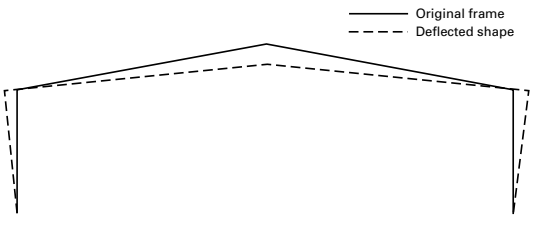



*Figure 1 Original and deflected portal frame*

Note 2B to clause 5.2.1(4) specifies when compression is "significant". Compression is significant if

$$\bar{\lambda} \geq 0.3\sqrt{\frac{Af_y}{N_{Ed}}}$$

This expression can be rearranged to show that compression is significant if the axial force in the rafter exceeds 9% of the Euler load, which in Eurocode terminology is when $N_{Ed} > 0.09\ N_{cr}$

$N_{cr}$ may be calculated conservatively based on the developed length of the rafter from column to

column, and an example shows that compression is generally significant.

Taking the example in P252 *Design of Single-span steel portal frames to BS 5950*, the example frame is 30m span, 7m to eaves, 6° slope, and the rafter is a 457 × 191 × 67 UKB. The maximum axial force in the rafter at ULS is 122 kN.

The developed length of the rafter is 30.165 m. Therefore,

$$N_{cr} = \frac{\pi^2 EI}{L^2} = \frac{\pi^2 \times 210000 \times 29400 \times 10^4}{30165^2 \times 10^3} = 670 \text{ kN}$$

9% of this load is 60.3 kN, indicating that the compression is significant, and the formula for $\alpha_{cr}$ cannot be used.

Thus for two reasons, the formula in BS EN 1993-1-1 is of little use for duo-pitch portals.

### Recommended approach to assessing second order effects.

The potential problems of the Eurocode approach applied to portal frames were recognised at an early stage, and an important paper on the subject was published in *The Structural Engineer* in November 2005[1]. Designers are encouraged to refer to this paper.

The paper discusses the problem, and presents a straightforward solution that is recommended for use in manual design when there is no software conveniently available for calculating $\alpha_{cr}$. Of course, most portal frame design is carried out using software, when more advance solutions are possible.

The recommended approach for manual design is to calculate an estimated measure of the frame's sensitivity, $\alpha_{cr,est}$. This estimated value is given by:

$$\alpha_{cr,est} = 0.8 \left[1 - \left(\frac{N_{R,ULS}}{N_{R,cr}}\right)_{max}\right] \times \alpha_{cr,H}$$

In the above expression, $\alpha_{cr,H}$ is calculated by applying equivalent horizontal forces (EHF) at the top of the columns, and calculating the lateral deflection. Importantly, the only loads on the frame for this analysis are the EHF. If the EHF are taken as 1/200 of the vertical reactions at each base, then $\alpha_{cr,H}$ may be calculated from:

$$\alpha_{cr,H} = \frac{h}{200\delta_h}$$

which will be familiar to UK designers.

where;

$h$ is the height of the column

$\delta_h$ is the maximum column top lateral deflection due to the EHF.

This basic value is then modified. The 0.8 factor allows for the second order effects in the columns, even when they are very slender, such as in high-bay warehouses, and the $\left(1 - \frac{N_{R,ULS}}{N_{R,cr}}\right)$ factor allows for the influence of the axial force in the rafter. $N_{R,ULS}$ is simply the maximum axial compression in the rafter, due to the factored loads. $N_{R,cr}$ is the Euler load for the rafter, exactly as calculated above. Because the 0.8 factor must

cover even tall slender columns, the expression for $\alpha_{cr,est}$ may be conservative, if say, the columns are short and stocky.

In the case of the example used above, the expression becomes:

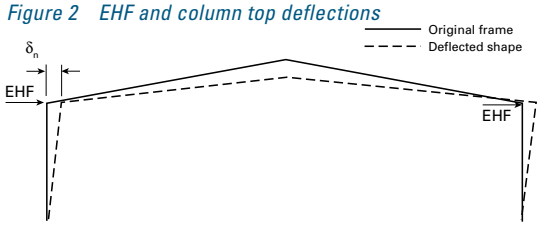
$$\alpha_{cr,est} = 0.8\left[1-\left(\frac{122}{670}\right)\right] \times \alpha_{cr,H} = 0.65 \times \alpha_{cr,H}$$

Continuing with the example, the vertical reactions at each base were 169.5 kN

The EHF were 169.5 / 200 = 0.85 kN

Applying these loads (only) to the bare frame, an elastic analysis gives the column top lateral deflection as 3.6 mm.

*Figure 2 EHF and column top deflections*




Thus $\alpha_{cr,H} = \dfrac{h}{200\delta_h} = \dfrac{7000}{200 \times 3.6} = 9.7$

Therefore $\alpha_{cr,est} = 0.65 \times \alpha_{cr,H} = 0.65 \times 9.7 = 6.3$

The result is less than 10, and therefore second order effects are not small enough to be ignored.

Applied loads must be multiplied by the factor

$$\frac{1}{1-\dfrac{1}{\alpha_{cr,H}}} = \frac{\alpha_{cr,H}}{\alpha_{vr,H}-1} = \frac{6.3}{6.3-1} = 1.19$$

In this example, the loads must be increased by 19% to allow for second order effects.

In the elastic analysis to determine the column-top deflections, it is recommended that allowance be made for base stiffness. For a nominally pinned base 10% of the column stiffness may be used as a base stiffness, and this would have the beneficial effect of reducing the lateral deflection, and increasing $\alpha_{cr,est}$

The recommended approach has limitations. It should not be applied in any of the following circumstances:

- where $L/h > 8$
- where $\alpha_{cr,H} \leq 3$
- tied portals

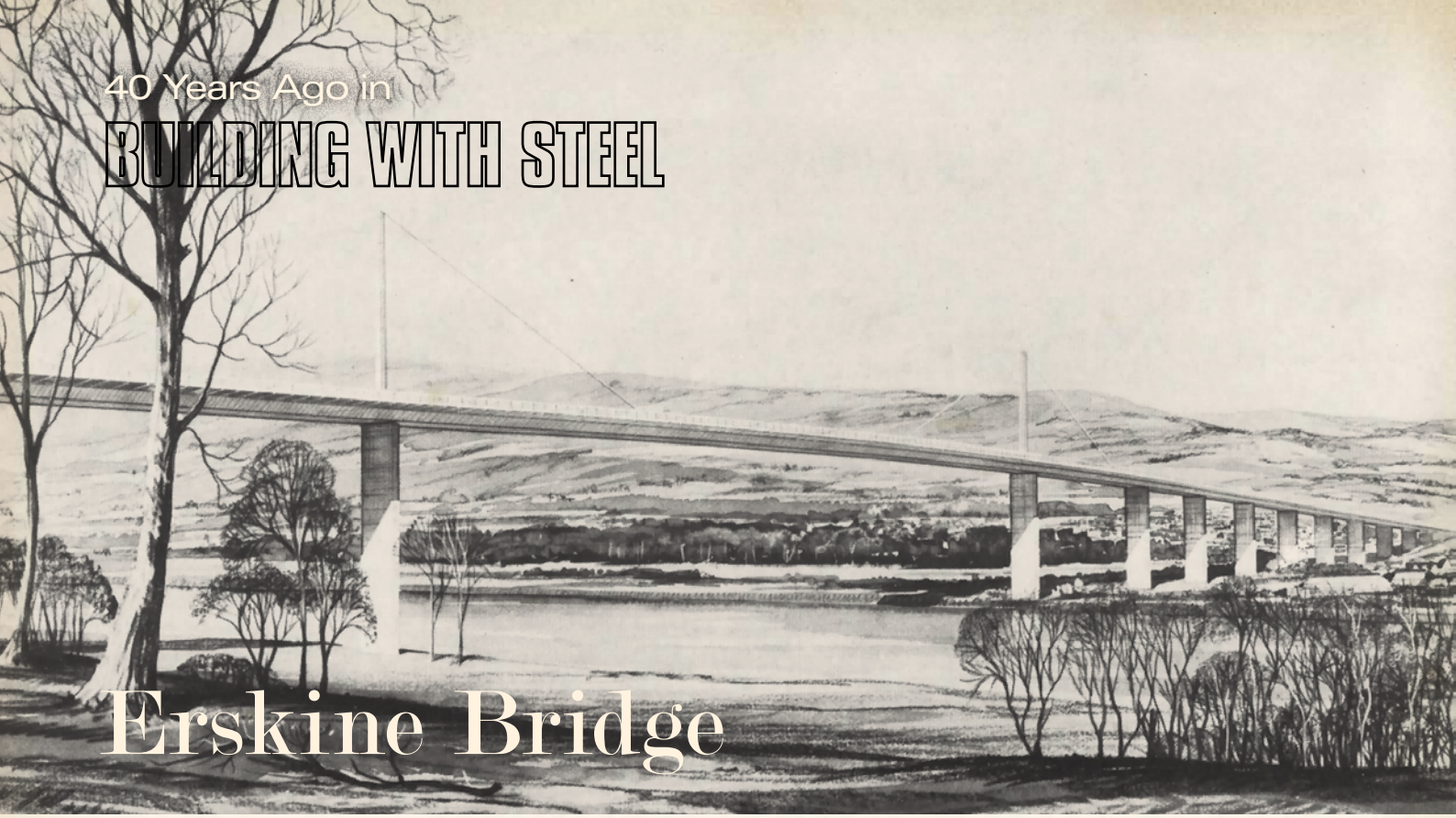
In these circumstances, second order software should be used.

## Conclusions

Most portal frames are designed using specialised software, which will allow for second order effects as part of the analysis. When carrying out manual design, or preliminary calculations, it is important to note that the Eurocode approach is not appropriate for pitched roof portals. An alternative approach to assess sensitivity to second-order effects is required, and the simple approach presented by Lim *et al* is recommended.

## References

1. Lim, *et al.* Eurocode 3 and the in-plane stability of portal frames.



# Erskine Bridge

There has been a ferry across the River Clyde between Erskine and Old Kilpatrick for centuries but the density of traffic has increased so much that one is now faced either with a long queue at the ferry or with a journey into Glasgow to use an alternative crossing. A new scheme has been drawn up linking the A8 (Glasgow-Gourock) and A82 (Glasgow-Inverness) trunk roads, costing over £8M. Erskine Bridge is part of this scheme.

The bridge is a multi-span all welded steel box girder on single shaft concrete piers in which the main span of 1,000ft will be the longest cable-stayed span in the world. To allow large ships such as the QE2 to continue using the Clyde there will be a minimum clearance of 180ft above HWOST.

### *Piers*

The fourteen piers are all single diamond shaped shafts of heights varying from 22 to 175ft. The shape was developed to give a slender, graceful appearance and to offer minimum wind resistance. The piers are constructed of concrete and are designed to flex longitudinally to accommodate movements of the bridge due to temperature changes.

### *Deck Structure*

The total length of the bridge is 4,334ft, comprising the main cable-stayed span of 1,000ft, two anchor spans of 360ft, and twelve approach spans, four on the south side and eight on the north, generally of 224ft. The total weight of steelwork involved is about 11,000 tons.

North prefabrication area

All movement doe to temperature changes is accommodated by the rolling leaf expansion joint in the deck between piers 7 and 8, and by a toothed deck joint and roller bearings at both abutments.

The steel deck girder is of elegant aerodynamic shape similar to those of the Severn and Wye bridges. It is generally 10ft 7½in deep at the centre with cantilevers on both sides to carry cycle tracks and footways. The total width varies from 102ft 6in at the main span, where the central reservation is wider, to 97ft 6in over the approach spans.

The supporting cables are 2½in diameter wire strands arranged in groups anchored to the steelwork in the central reservation and passing over 125ft high tapering steel masts of box section rising from the main piers.

The roadway surface is of mastic asphalt affixed directly to the steel deck plate. Design of the cycle tracks is such that they may be used to extend the carriageway whenever the expected increase in volume of traffic should warrant a third lane. Four 24in diameter water mains and two 12in diameter gas mains will be carried below the footways so that any maintenance on them will not interrupt traffic flow.

### *Fabrication*

The all-welded trapezoidal box girder of high yield stress steel to B.S.968 consists of a deck plate, ½in thick throughout, sloping web plates generally ⅜in thick but increased to 7/16in thick and ½in in parts of the main and anchorage spans, and a bottom plate ½in thick at the piers, ¾in thick at the towers or otherwise ⅜in thick.

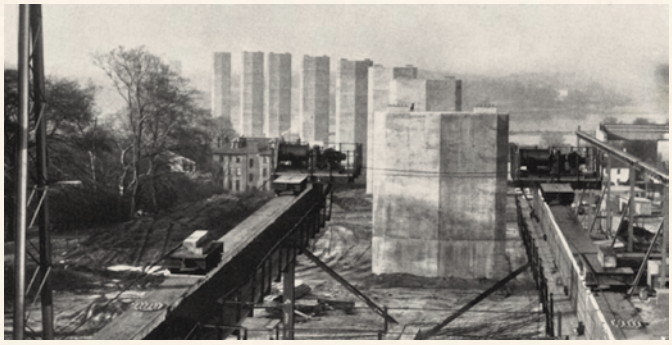
All the plates have continuous longitudinal stiffeners which pass through transverse stiffening plates at 14ft centres. The longitudinal stiffeners for the deck plate are V-shaped at 2ft centres; those for the bottom flange and lower web sections are 8in bulb flats at 1ft 4in centres; for the upper and central web sections, they are 5in bulb flats at 2ft centres.

Diaphragms of stiffened plate, ¼in thick except over the piers where the thickness is increased to 1in, also occur at 14ft centres and they are welded to the transverse stiffening plates referred to above.

The steelwork is prepared and welded up in the fabricator's shops into components suitable for transport to the site by road. These units are generally 56ft long, 8ft wide and 12 to 15ft deep. On arrival at the site they are offloaded either on the north or the south bank where sit assembly yards have been established adjacent to the to the abutments. At the site the components are welded and bolted together to form 56ft long boxes complete with cantilevers ready for lifting into bridge. The greatest care is taken in this assembly, by fabricating each box

against its preceding and succeeding neighbours, to ensure that the boxes, which weigh from 120 to 160 tons each, will fit without difficulty when offered up at the bridge head.

Fabrication of the V-Shaped stiffeners is worthy of special mention. So far in Britain it had been possible to produce such members only by pressing and in lengths limited by the size of the press. Because of the advantages of continuous longitudinal stiffeners, however, the steelwork fabricator has developed a rolling process by which they can now be produced in any desirable length. This process involved the adaptation of machinery previously used for producing similar profiles but in lighter gauge material and of smaller girth. The V-stiffeners for Erskine Bridge are of ¼in thick high yield stress steel with a depth of 9in and a girth of 24in.



**Above:** View showing piers

### *Erection*

Erection of the steelwork is so planned that the centre will be reached from both ends simultaneously. This meant starting on the north abutment where the first two spans were erected by specially designed gantry cranes on falsework and welded up so that the remainder of the boxes could be erected by the cantilevering process.

Each succeeding box is lifted onto trolleys on the second span and winched out to the bridge head where specially designed launching girders are used to lower it and then to support it in position while it is welded to the preceding section. The launching girders, developed from those used for the Wye Bridge, are then moved forward ready to receive the next box.

Before the last section of any approach span can be positioned, the cantilevered part has to be jacked up with the aid of a temporary prop to counteract the sag of about 4ft so that the next section will pass over the top of the supporting pier.

When the anchor and main spans are erected, special steps will be taken because the box is not strong enough to span the distances concerned. In the 360ft long anchor span, a temporary intermediate pier will be erected to limit the effective span to about 240ft. In the case of the main span, however, where the deck girder has to cantilever out 500ft to the centre, use will be made of permanent cables. When the girder cantilevers about 190ft, the steel mast will be erected over the main pier and some of the cable strands will be attached in temporary positions to support the steelwork while erection proceeds. As soon as the bridge head has advanced sufficiently (about 375ft from the mail pier), the remainder of the strands will be attached in their final positions and the rest of the box sections can be cantilevered out.

On closing the bridge, the temporary cable strands will be fixed in their permanent positions.

# Broadgate Phases 1 to 4

## 1989 ECCS design award winner

**Judges' Comments:**
**The use of steelwork enabled this project to be completed in a very short time without sacrificing architectural quality and maintaining the economy of the project.**

Phases 1 to 4 form the first four phases of an office development on a site developed by Rosehaugh Stanhope plc in conjunction with British Rail, adjacent to Liverpool Street Station in London.

It is said that the renaissance of structural steelwork for office buildings started with Broadgate and as such it is perhaps the most significant and valuable of all recent developments in London.

It is well known that the development concepts, construction techniques, management and contracting arrangements are all American inspired resulting in a phenomenally fast and successful building programme.

The buildings are eight storeys high, placed around a new open public square which is central to the development in that the square not only provides pedestrian access routes across it but is also used as an amphitheatre for open air entertainment in the summer as well as an ice rink in the winter. The buildings are stepped in elevation with the terraces thus formed being landscaped.

The client's briefing required a design for the buildings to be efficiently planned, functional, cost-effective and of a high quality to attract potential tenants in a highly competitive letting market. Also included in the brief was the need for an early completion of the individual buildings.

The choice of steel for the structural frame reflects this need. Speed of construction was a major consideration but quality could not be compromised. To achieve this a robust design with simple details was developed which enabled the very tight programmes to be met.

On Phases 1 and 2 over 3,560 tonnes of steel were built in just 26 weeks from date of order. Building of Phases 3 and 4 was similarly quick.

The frame is constructed of UB/UC stanchions and beams with the stanchions being designed/detailed in three storey high lifts. The beams are designed compositely with the 130mm thick concrete slab which was constructed on a metal deck using shear studs welded to the beams through the metal deck. The steel frame commences directly from the pile cap. Horizontal stability is provided by diagonally braced frames in the core area. The stairs were all constructed in steelwork, fabricated off site using folded plate pans fixed to flat stringers. The pans are filled with concrete off site and the stair flights erected with the main steelwork to provide access to the floor during construction.

The steel frame within the air conditioned building has not been treated save for a light cleaning of the rust and mill scale. Outside the building envelope, the steelwork has been cased in concrete and wherever possible this has been done off site. Fire protection is either by vermiculite cement or board.

*Owner:*
Stanhope Properties plc
*Architects:*
Arup Associates
*Structural Engineers:*
Arup Associates
*Steelwork Contractor:*
Redpath Dorman Long Ltd

celebrating

# excellence in steel

## Call for entries for the 2010 Structural Steel Design Awards

Corus and The British Constructional Steelwork Association have pleasure in inviting entries for the 2010 Structural Steel Design Awards.

The Awards celebrate the excellence in the United Kingdom and Republic of Ireland in the field of steel construction, particularly demonstrating its potential in terms of efficiency, cost effectiveness, aesthetics and innovation.

The Awards are open to steel based structures situated in the United Kingdom or overseas that have been built by UK or Irish steelwork contractors using steel predominantly sourced from Corus. They must have been completed and be ready for occupation or use during the calendar years 2008-2009; previous entries are not eligible.

To find out more and request an entry form visit:

www.steelconstruction.org
or call Gillian Mitchell of BCSA on 020 7747 8121

Closing date for entries:
Friday 4 December 2009

BCSA

corus

# AD 339
# Stainless steel in contact with other metals

Advisory Desk Note AD338 gave a summary of sources for guidance on the use of stainless steel. One of the publications referred to, *Stainless Steel in Contact with Other Metallic Materials*, published by Euro Inox, addresses the issue of galvanic (bimetallic) corrosion. This Advisory Desk Note summarizes the guidance given in that publication and also the recommendations in the *Design Manual for Structural Stainless Steel*.

### Principles of galvanic corrosion

When two dissimilar metals are in contact and also bridged by an electrolyte (i.e. an electrically conducting liquid), a current flows from the anodic metal to the cathodic or nobler metal through the electrolyte. As a result, the less noble metal may corrode at a rate far higher than would be expected if it were not in contact with the noble metal. The more noble material (the cathode) is protected against corrosion. In some cases, this can lead to corrosion in metals that would otherwise be corrosion resistant in the environment in question. Seawater is a strong electrolyte; however, rain or humidity may be enough to trigger a galvanic reaction.

Stainless steels usually form the cathode in a bimetallic couple and therefore do not suffer corrosion. Contact between austenitic stainless steels and aluminium may result in some additional corrosion of the latter metal. This is unlikely to be significant structurally, but the resulting white/grey powder may be deemed unsightly. Galvanized steel in contact with stainless steels is not normally considered to be a serious corrosion risk, except possibly in severe (marine type) environments. Contact with copper should generally be avoided. When welding stainless steel to carbon or low alloy steel, it is important to select welding consumables that are at least as noble as the parent material.

### Parameters which affect the risk of galvanic corrosion

The risk of galvanic corrosion occurring is difficult to predict as it depends on numerous factors. Apart from the metals themselves, environment and design are crucially important. The main factors are addressed below.

### Potential difference

The potential difference between the two metals alone is not a good indicator of the actual risk of galvanic corrosion. The important factor is not the difference of potential observed under standardized experimental conditions but rather the actual difference of potential under real conditions (where the presence of surface oxide films, effects of area ratios and different electrolyte chemistry all have an effect).

### Conductivity of electrolyte

The risk of galvanic corrosion increases with increasing electrolyte conductivity. Water film resulting from condensation would be an example of an electrolyte with low conductivity while sea water is an electrolyte with high conductivity.

### Wetting duration and environments

There is a strong interaction between electrolyte conductivity and duration of wetting. This is of critical importance wherever components are not permanently wetted. Both length of exposure and electrolyte conductivity are strongly dependent on local conditions. In marine, industrial or indoor swimming pool environments, the risk of galvanic corrosion is significantly higher than in rural atmospheric conditions. Besides ambient atmosphere, design details play a decisive role. Factors that help humidity films to dry quickly (adequate aeration, prevention of crevices, free drainage of rainwater) reduce corrosive attack. Permanently humid areas in crevices or covered areas, stagnant water and solid surfaces can considerably accelerate galvanic corrosion.

### Cathode and anode area

The risk of attack is greatest if the area of the more noble metal (e.g. stainless steel) is large compared with the area of the less noble metal (e.g. carbon steel). Adverse area ratios are likely to occur with fasteners and at joints. Carbon steel bolts in stainless steel members should be avoided because the ratio of the area of the stainless steel to the carbon steel is large and the bolts will be subject to aggressive attack. Conversely, the risk of attack of a carbon steel member by a stainless steel bolt is negligible. It is usually helpful to draw on previous experience in similar sites because dissimilar metals can often be safely coupled under conditions of occasional condensation or dampness with no adverse effects, especially when the conductivity of the electrolyte is low.

### Preventing galvanic (bimetallic) corrosion

Galvanic corrosion is rarely a problem in building environments, although it is generally accepted as good practice to take the preventative measure of inhibiting current flow between the dissimilar metals. There are two means to achieve this:

- insulating the dissimilar metals, i.e. breaking the metallic path,
- preventing electrolyte bridging by breaking the electrolytic path, by applying paint or other coating. Where protection is sought by this means and it is impracticable to coat both metals, then, surprisingly, it is preferable to coat the more noble metal (i.e. coat the stainless steel, in the case of a stainless steel / carbon steel connection).

### Further information:

Stainless steel in contact with other metallic materials. Materials and Applications Series, Volume 10, Euro Inox, 2009. Available from *www.euro-inox.org*

Design Manual for Structural Stainless Steel. Euro Inox and the Steel Construction Institute, Third Edition, 2006. Available from *www.euro-inox.org* and *www.steel-stainless.org/designmanual*

PD 6484:1979 Commentary on corrosion at bimetallic contacts and its alleviation. (This PD documents the general behaviour of metals in bimetallic contact in rural, urban, industrial and coastal environments.)

BSSA provide technical information on this subject on their web site *www.bssa.org.uk* and they also run a Stainless Steel Advisory Service for technical queries (Telephone 0114 2671265, Email *ssas@bssa.org.uk*). BSSA offer a range of Continuing Professional Development modules on the use of stainless steel in construction for in-house training.

**Contact:** Nancy Baddoo
**Tel:** 01344 636525
**Email:** advisory@steel-sci.com



# New and Revised Codes & Standards

(from BSI UpdatesOctober 2009)

### PUBLISHED DOCUMENTS

**PD 6703:2009**
Structural bearings. Guidance on the use of structural bearings
*No current standard is superseded*

### CORRIGENDA TO BRITISH STANDARDS

**BS EN 1993:-**
Eurocode 3. Design of steel structures
**BS EN 1993-5:2007**
Piling
CORRIGENDUM 1

# USFBs or CONCRETE ?

## ULTRA FAST CONSTRUCTION

**From ex-stock steel, so accelerates any site programme. Supplied through any steelwork contractor.**

Engineer: PWP Consulting Engineers

**Milliners Wharf, Manchester**
Luxury 8-storey residential development using 7.8m span USFBs with 225mm deep metal deck supported on bottom flange, and with concrete flush to top flange.

## ULTRA COMPETITIVE PRICES

**Compares favourably with the cost of flat-slab concrete.**

Engineer: Whitby Bird

**Phoenix Medical Centre, Newbury**
9.2m span USFBs, carrying PC units and cambered 27mm.

## ULTRA SHALLOW FLOORS

**As shallow or shallower than flat-slab concrete.**

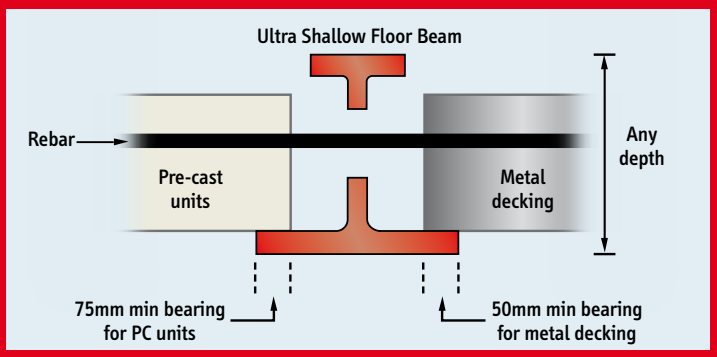
Engineer: SKM Anthony Hunt

**George IV Bridge, Edinburgh**
Eight floors of hotel and retail space with floor depths as shallow as 160mm.

**Ultra Shallow Floor Beams - faster, cheaper & shallower construction.**

**For FREE & immediate designs contact**

# 01924 264121




ASD Westok Limited, Charles Roberts Office Park, Charles Street
Horbury Junction, Wakefield, West Yorkshire WF4 5FH
Fax: 01924 280030 Email: info@asdwestok.co.uk

**www.asdwestok.co.uk**

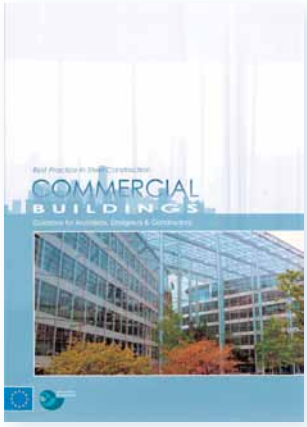
ASD Westok. Part of the ASD metal services group.

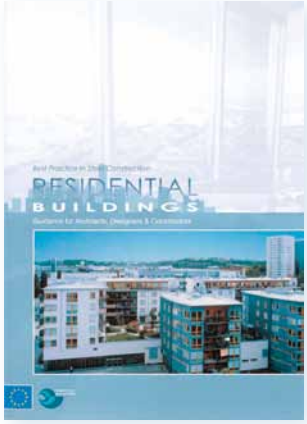
Westok USFB® ULTRA SHALLOW FLOOR BEAM

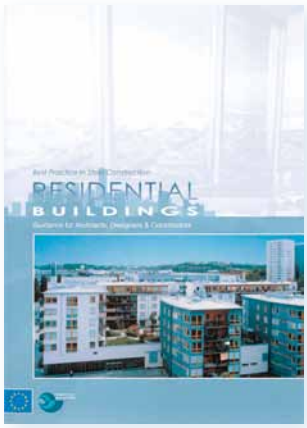
*For SCI Publications please contact Publication Sales:*
*Tel: Direct 01344 636505 Fax: 01344 636570*
*Email: publications@steel-sci.com*
*website: www.shop.steelbiz.org*
*The Steel Construction Institute, Silwood Park, Ascot SL5 7QN*

# Best Practice in Steel Construction (Commercial, Residential and Industrial Buildings)

## Guidance for Architects, Designers & Consultants




*Catalogue References:*
*EP35, EP36, EP37*
*Authors: Euro-Build in Steel Project*
*60pp each, A4, paperback,*
*Illustrated in colour;*
*2009*

*PRICES: £30 for a set of three or £15 for individual titles (plus P&P)*

The three publications in this series are aimed at architects and other members of the design team to assist in decision-making in the early stages of planning steel framed buildings. They cover general issues in steel design and construction relevant to the three building sectors (commercial, residential and industrial) and include a number of recent case studies from around Europe.

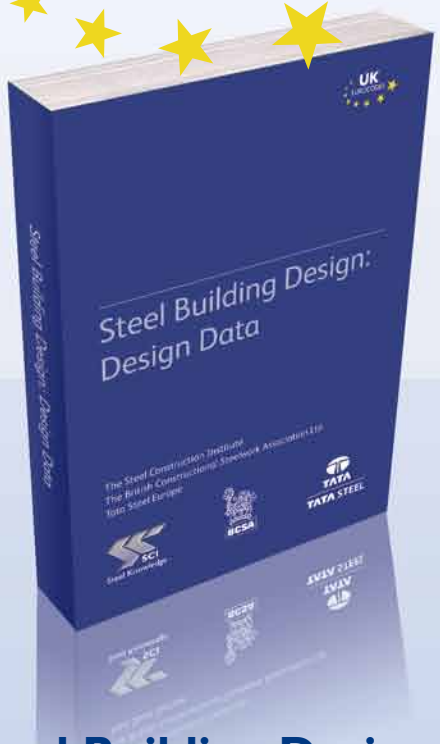
In addition to the general issues, the relevant information for each building sector is included:

**Commercial:** Special floor systems and beam connections

**Residential:** Wall systems, primary steel frames, modular systems, façades and roof systems and national practice.

**Industrial:** Support structures, roof and wall systems, and national practice.

ESSENTIAL EUROCODES EDITION




# Steel Building Design: Design Data

*(The Blue Book)*

The New "Blue Book" referencing the Eurocodes is the essential design aid for steelwork.

Comprehensive tables of member resistances are given, in S275 and S355, to enable rapid selection of steel members in compression, bending, tension. All common member types and serial sizes are covered.

This edition provides member resistances in accordance with BS EN 1993-1-1, including the application of the UK National Annex.

Costs:
Non BCSA/SCI Members: **£80**
BCSA/SCI Member price: **£60**

To purchase your copy contact:
BCSA: +44 (0)207 839 8566
SCI: +44 (0)1344 636505

BCSA

SCI
Steel Knowledge

# 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 £6,000,000 |
| Angle Ring Company Ltd | 0121 557 7241 | | | | | | | | | | | | ● | | | | Up to £800,000 |
| 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 8954 0028 | | | | ● | | | | | ● | ● | | | ● | ● | ✓ | 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 £100,000 |
| 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 |
| BSB Structural Ltd | 01506 840937 | | | ● | ● | ● | | | | | | | | | ● | | Up to £800,000 |
| Cairnhill Structures Ltd | 01236 449393 | | | | ● | ● | ● | ● | | ● | ● | | | ● | ● | ✓ | Up to £1,400,000 |
| Caunton Engineering Ltd | 01773 531111 | ● | ● | ● | ● | ● | ● | ● | | | ● | ● | | ● | | ✓ | Up to £6,000,000 |
| Chieftain Contracts Ltd | 01324 812911 | | | ● | ● | | | | | | | | | | ● | | Up to £400,000 |
| Cleveland Bridge UK Ltd | 01325 502277 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | | ✓ | Above £6,000,000* |
| CMF Ltd | 020 8844 0940 | | | | ● | | ● | ● | | ● | ● | | | | ● | | Up to £6,000,000 |
| Compass Engineering Ltd | 01226 298388 | | | ● | ● | | ● | | ● | | | | | | | | Up to £2,000,000 |
| Conder Structures Ltd | 01283 545377 | | ● | ● | ● | ● | ● | | | | ● | ● | | ● | ● | ✓ | Up to £6,000,000 |
| Cordell Group Ltd | 01642 452406 | ● | | | ● | ● | ● | ● | ● | ● | ● | | | | | ✓ | Up to £3,000,000 |
| Coventry Construction Ltd | 024 7646 4484 | | | ● | ● | ● | ● | | ● | ● | ● | | | ● | ● | | Up to £1,400,000 |
| Cronin Buckley Fabrication & Construction Ltd | 00 353 21 487 0017 | | | ● | ● | ● | ● | | | | ● | | | | | | Up to £6,000,000 |
| 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 £200,000 |
| 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 |
| Frank H Dale Ltd | 01568 612212 | | ● | ● | ● | ● | | | | | | | | | | ✓ | Up to £6,000,000 |
| 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 |
| Harry Peers Steelwork Ltd | 01204 558500 | | | ● | ● | ● | ● | ● | ● | ● | ● | | | ● | | ✓ | Up to £4,000,000 |
| 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* |
| John Reid & Sons (Strucsteel) Ltd | 01202 483333 | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | | | Up to £6,000,000 |
| Leach Structural Steelwork Ltd | 01995 640133 | | | ● | ● | ● | ● | ● | | | ● | | | | | | Up to £1,400,000 |
| Leonard Cooper Ltd | 0113 270 5441 | | | | ● | | ● | | ● | | ● | | | ● | | | 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 £800,000 |
| 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 £4,000,000 |
| 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 |
| On Site Services (Gravesend) Ltd | 01474 321552 | | | | ● | | ● | ● | | ● | ● | | | | ● | | Up to £400,000 |
| Overdale Construction Services Ltd | 01656 729229 | | | ● | ● | | ● | ● | | | ● | | | | ● | | Up to £800,000 |
| 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 |
| Remnant Engineering Ltd | 01564 841160 | | | | ● | | ● | ● | | ● | | | | | ● | ✓ | Up to £400,000* |
| Rippin Ltd | 01383 518610 | | | ● | ● | ● | ● | ● | | | | | | | | | Up to £2,000,000 |
| Roberts Engineering | 01482 838240 | | | | ● | | | | | ● | | | | ● | ● | | Up to £100,000 |
| Robinson Construction | 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 |
| Selwyn Construction Engineering Ltd | 0151 678 0236 | | | | | | | | | ● | ● | | | | ● | ✓ | Up to £200,000 |
| 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 |
| The Steel People Ltd | 01622 715900 | | | | ● | | | | | ● | | | | | ● | | Up to £100,000 |
| Traditional Structures Ltd | 01922 414172 | | ● | ● | ● | ● | ● | ● | ● | | ● | ● | | ● | | ✓ | Up to £2,000,000* |
| 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 | ● | | | | | | | | |
| Alternative Steel Co Ltd | 01942 610601 | | | | | | | | ● | |
| 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 | | | | | | | ● | | |
| Combisafe International Ltd | 01604 660600 | | | | | | | ● | | |
| 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 Bristol | 01454 315314 | | | | | | | | ● | |
| Corus Dartford | 01322 227272 | | | | | | | | ● | |
| Corus Ireland Service Centre | 028 9266 0747 | | | | | | | | ● | |
| Corus Newcastle | 0191 414 2121 | | | | | | | | ● | |
| 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 | ● | | | | | | | | |
| **Company name** | **Tel** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |

| Company name | Tel | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 722260 | ● | | | | | | | | |
| 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 | ● | | | | | | | | |
| Industrial Shotblast & Spraying Ltd | 0845 130 6715 | | | | | | ● | | | |
| 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 (UK) Ltd | 01355 232266 | ● | | | | | | | | |
| 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 | ● | | | | | | | | |
| Struthers & Carter Ltd | 01482 795171 | | | | | | | | ● | |
| Studwelders Ltd | 01291 626048 | ● | | | | | | | | |
| Tekla (UK) Ltd | 0113 307 1200 | | ● | | | | | | | |
| Tension Control Bolts Ltd | 01948 667700 | | | | | | | | | ● |
| Trailerpal Ltd | 01743 446666 | | | | | | | ● | | |
| Voortman UK Ltd | 01827 63300 | | | | | ● | | | | |
| Wedge Group Galvanizing Ltd | 01909 486384 | | | | | | ● | | | |
| **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 Ltd | 01733 558989 | ● | ● | ● | ● | | ● | ● | ✓ | Up to £800,000 *Operating under CVA* |
| 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 |
| TEMA Engineering Ltd | 029 2034 4556 | ● | ● | ● | ● | ● | ● | ● | ✓ | Up to £1,400,000* |
| Varley & Gulliver Ltd | 0121 773 2441 | ● | | | | | | ● | ✓ | Up to £2,000,000 |
| Watson Steel Structures Ltd* | 01204 699999 | ● | ● | ● | ● | ● | ● | ● | ✓ | Above £6,000,000 |

* Denotes membership of the BCSA

# Bringing it all together
# **right down to the nuts and bolts!**

Fabrication Information Modelling (FIM) incorporating StruCad and StruM.I.S enables you to deliver your projects with maximum efficiency and full materials traceability.

AceCad's FIM solution enables seamless supplier integration and the tracking of components, including purchasing, inventory and document management for CE Certification. With AceCad Software's FIM solution you will be able to monitor every stage of your project - right down to the last nut and bolt!

**AceCad**
SOFTWARE

StruCad

StruM.I.S

www.**acecadsoftware**.com

**T.** +44 (0)1332 545800