MARCH 2010 VOL 18 NO 3

NSC

NEW STEEL CONSTRUCTION

www.new-steel-construction.com

City banks on steel
British Library automates
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Newport readies for Ryder Cup

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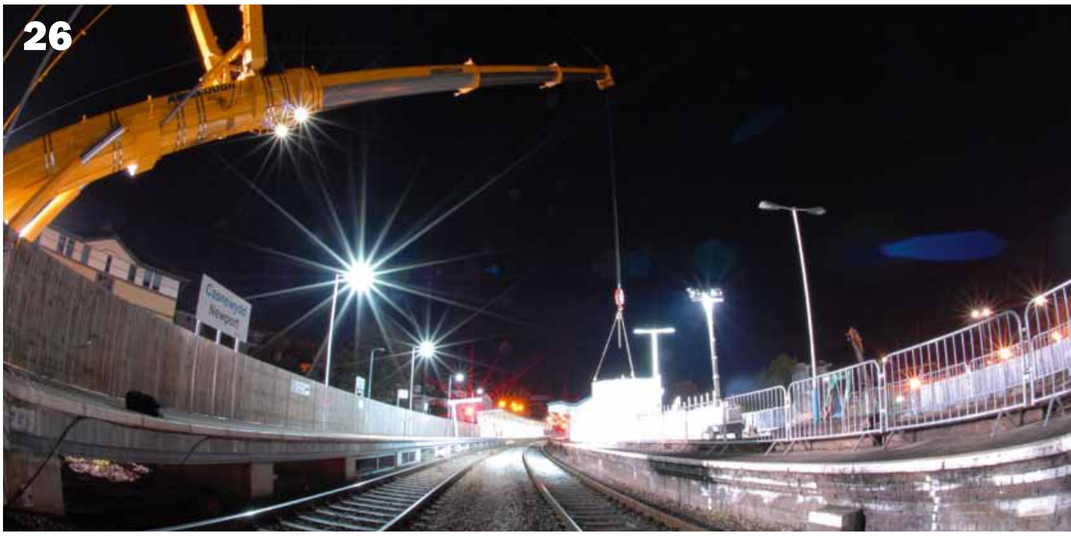

These and other steelwork articles can be downloaded from the New Steel Construction website at www.new-steel-construction.com

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New Court, City of London
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Architect: Allies and Morrison
Steelwork contractor:
Rowen Structures
Steel tonnage: 1,900t

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The British Constructional Steelwork Association Ltd

Steel tops low carbon class

Head teachers sitting in the award winning new modern schools of the sort that steel construction provides can award themselves gold stars for their contribution to sustainability. The first of the BCSA/Corus Target Zero reports that has just been released highlights the significant contribution that steel-framed schools are already making to lowering the UK's carbon footprint (see News).

It is appropriate that secondary schools are the first category of building to benefit from the Target Zero analysis as the project itself represents an effort to educate the market about steel's strong carbon message. Target Zero, whose results will be widely disseminated in the industry proves that using structural steelwork for a school building frame generates a lower carbon impact than an in-situ concrete frame. The study also provides further evidence that relatively light steel frames provide much the same thermal mass performance as heavyweight concrete building frames. Concrete's apologists – pay attention at the back - still make claims about its superior thermal mass, but from the bottom of the class.

This is just the first output from the Target Zero initiative, and designers will soon have all the guidance they need to meet emissions targets towards the goal of zero carbon for a wide range of building types.

The three-year Target Zero project was launched by the BCSA and Corus to provide designers with practical help in creating buildings that support the Government's zero carbon target for buildings to be achieved by 2019. It is estimated that as much as £165M can be shaved off the annual heating bill for schools by using steel in the ways suggested in the Target Zero report. Further emissions reducing benefits are expected to be delivered when the other reports in the project are completed, looking at warehouses, offices, supermarkets and mixed-use developments.

There is a lot of talk about sustainability from all sides of the industry, but Target Zero is the first time a detailed comparison has been undertaken of different energy efficiency measures, low and zero carbon technologies and Allowable Solutions, to pinpoint the most cost effective means of reducing emissions. The steel construction sector deserves credit for this effort.

A lot of hard work has gone into producing this guidance, mostly by independent sustainability specialists at AECOM, and the results of their research are possibly not exactly what even those who regard themselves as well up on sustainability issues would have expected. For those coming from a standing start seeking guidance in what is a complex area the Target Zero studies will be invaluable. Make sure you keep abreast of them at *www.targetzero.info* where you will be able to read the full reports for free as they become available over the coming months.

Nick Barrett - Editor

Sustainable schools guidance published

Target Zero the first project to undertake a detailed comparison of different energy efficiency measures, low or zero carbon technologies and Allowable Solutions to identify the most cost effective means of carbon reduction has published the first of its independent guides.

Commissioned by Corus and the BCSA, Target Zero's aim is to provide guidance on the design and construction of sustainable, low and zero carbon buildings in the UK.

The first of five guides covers secondary schools, and the research was based on Christ the King Centre for Learning secondary school in Knowsley, Merseyside.

Corus General Manager Alan Todd said: "The work has been undertaken by leading organisations in the field of sustainable construction to provide information and guidance for construction clients and their professional advisors on how to design and construct sustainable secondary school buildings.

"The findings of this guide will inform those that have been set the zero carbon challenge to turn the aspirations of Government into reality."

Key findings of the Schools report included:

The likely 2010 Part L compliance target of reducing operational carbon emissions by 25% is achievable using energy efficiency measures.

Operational carbon emission reductions up to 119% of regulated emissions, (96% of total carbon emissions) can be achieved using a package of energy efficiency measures, plus a 50kW wind turbine, 1,300m² photovoltaics, a biomass boiler and 216m² of solar thermal panels.

The study found that no current single on-site low or zero carbon technology could achieve true zero-carbon.

Using structural steelwork for the building frame has a lower embodied carbon impact than an in-situ concrete frame.

No significant difference was found in the thermal mass performance of the heavy-weight concrete frame option compared with the lighter steel framed solution

For further information and a copy of the full report visit *www.targetzero.info*

Steel structure keeps Velodrome on track

Work has been completed on the steel structure of the London 2012 Velodrome, keeping it on track to be the first venue to be finished in the Olympic Park in early 2011.

The 6,000 seat Velodrome will host the Olympic track cycling events, and after the Games it will be used by elite athletes and the local community.

Approximately 1,000t of steel has been erected on the project by Watson Steel Structures, working on behalf of main contractor ISG. The steelwork sections rise in height by 12m from the shallowest point to the highest part of the structure, helping form the distinct double curved roof structure which has been designed to reflect the geometry of the cycling track.

Work is now underway to install the venue roof which consists of one of the largest cable net roof lifts in the UK, using some 16km of cable. The venue is also one of the most sustainable structures in the Olympic Park and the lightweight roof will only weigh 30kg per m², roughly half that of any other covered Velodrome, helping create a highly efficient building.

Bridge boost for Olympic rowing venue

A new steel composite bridge has been lifted into place at Eton College Rowing Centre, keeping plans on schedule for enhanced Rowing and Canoe Sprint facilities for the 2012 Games.

The 50m long bridge - erected by Rowecord Engineering on behalf of main contractor Morrison Construction - forms part of the work to upgrade the venue's existing facilities and access routes.

Olympic Delivery Authority Chief Executive David Higgins said: "Eton College Rowing Centre is a first class venue and the enhancements we are delivering will create the best possible facilities for the world's best athletes. Lifting a new bridge into the finish line area completes a key part of the works and keeps us on track to deliver the venue before the Games."

Work at the venue is expected to be completed during the next two months.

Bottom of construction's business cycle reached

British Constructional Steelwork Association President Jack Sanderson said the bottom of construction's business cycle had now been reached and government statistics signalled a rebound in some sectors of the industry.

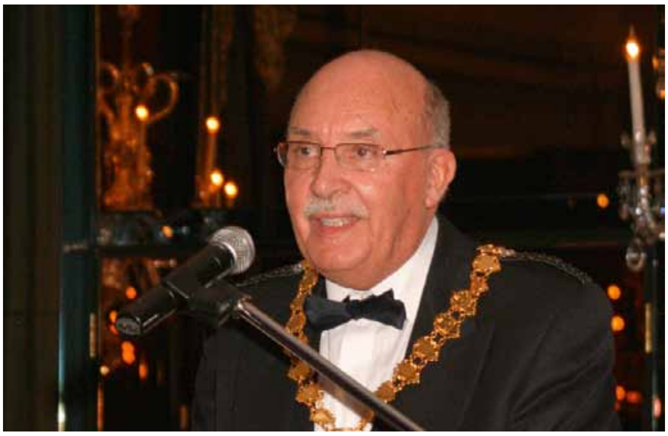
Speaking at BCSA's National Dinner Mr Sanderson said: "As we all know the economic fortunes have changed dramatically over the past 18 months and most BCSA members have had to adjust their capacity accordingly. 2010 is likely to be another very difficult year, but hopefully we are now at the bottom of the fall in steel construction demand."

Mr Sanderson quoted figures showing a rise in new private commercial orders in the three months to December 2009 of18% compared with the previous three month period; with new private industrial orders in the three months to December 2009 up 24% compared with the previous three month period.

Mr Sanderson said a significant victory was achieved by BCSA and its lobbying partners last year in successfully opposing the opt-out to the Working Time Directive. Another success was achieving payment terms amendments to the Construction Act contained in Part 8 of the Local Democracy, Economic Development and Construction Act.

Health and Safety was a key focus for BCSA efforts during the year. Mr Sanderson said:'Members have made a lot of effort to drive accidents and injuries down and I am pleased to report that accident data for 2009 shows the industry has met the target set by the construction industry and reduced reportable accidents by 66% in a ten year period.'

Mr Sanderson said he was pleased to announce the launch with Corus of the 'Target Zero' Design Guide for Schools. This is a £1M sustainability project, produced by a project team led by AECOM with the aim of making steel intensive zero carbon buildings a reality.



British Constructional Steelwork Association President Jack Sanderson

Mr Sanderson said he is pleased that the Department for Communities and Local Government (DCLG) has postponed the amendment to Approved Document A – Structure until 2013, so national design standards will continue to be listed as acceptable methods of complying with the Building Regulations. The BSI committee responsible for BS 5950 has confirmed the continued use of BS 5950 until 2015.

Steel's sustainability advantage

Chair of the Association for Consultancy and Engineering, Michelle McDowell

Guest speaker Michelle McDowell, Chair of the Association for Consultancy and Engineering, said signs were already being seen of improvement in the industry's prospects. 'This year will continue to be difficult but slowly things will change, and change for the better,' she said. 'I think we are already seeing that.'

Ms McDowell said there were some positive areas in the market, for example the Building Schools for the Future and City Academy programmes.

ACE members were confident about the future and saw a return to growth partly coming from the move to a low carbon economy. She said:' I believe engineers, and all those involved in the manufacturing and industrial sector, are the people who have the answers to this challenge.'

The UK needed major investments in upgrading infrastructure in the energy, transport, water and sewerage as well as in upgrading homes, offices and factories if sustainability objectives are to be met, she argued. Ms McDowell said: 'The BCSA's work to develop new low and zero-carbon steel intensive buildings is a fantastic step in the right direction. I, and many of my colleagues, welcome BCSA's launch today of the Target Zero Design guide for Schools. Driving down the carbon cost of steel is now a great way to boost steel use as a building material. Indeed steel already has one big advantage in that it is already recycled or re-used.

Speedy rebuild for fire damaged complex

Steel construction has played a vital role with the successful rebuild of the fire damaged Wealmoor fresh produce packaging warehouse in Atherstone, Warwickshire.

The facility hit the headlines in November 2007 when a devastating fire gutted a large portion of the warehouse, while four firemen were tragically killed putting out the blaze.

Wealmoor had been working out of a temporary depot during the rebuild programme, but has now relocated all of its employees back to its enlarged former premises.

Working with main contractor Bowmer and Kirkland Building Services, Caunton Engineering erected 300t of structural steelwork for the project. This consisted of a new twin portal frame main warehouse which measures 82m x 67m and includes an internal two storey office block, and a separate 27m x 65m packing building.

"The main building is attached to the part of the existing warehouse which didn't burn down," said Gareth Skelton, Caunton Contract Manager. "For the old building we supplied new steelwork, a service gantry, along with a brand new gable end."

AROUND THE PRESS

New Civil Engineer

11 February 2010

A home coming for the seagull

Steelwork also provides the signature element of the project - the roof. It will be an undulating and sloping structure designed to reflect the local South Downs. To achieve this two large trusses will span either side of the stadium, above the east and west stands, supporting this roof.

New Civil Engineer

14 January 2010

Raising the roof on 2012

The first of the 15m high, 85t steel sections of the supporting structure was lifted into place at the end of January last year. The giant white truss that runs around the outside of the stadium supports the roof and is structurally independent from the rest of the bowl steelwork.

Building Magazine

29 January 2010

Wheels of steel

Work has been completed on the steel structure of the £80M London 2012 velodrome at the Olympic Park in east London. ISG started building the 6,000-seater cycling venue in March 2009, with Bolton-based Watson Steel supplying 2,500 sections of fabricated steel in a deal worth more than £3M.

Building Magazine

5 February 2010

Twist and shout

The conventional columns couldn't be used to support the floorplates at the building's perimeter, so a steel diagrid was used. This would be able to follow the complex shape of the building, and form a shell that could help to support the floors.

Consultation on British Standards in Scotland

Following a meeting between BCSA President Jack Sanderson and the Regulatory Review Group (reporting annually to the Scottish Government) Chairman Russel Griggs, to discuss the implementation of the Eurocodes and the use of national standards after this month (March), there is a possibility that references to both the Eurocodes and the equivalent withdrawn British Standards will be included in the Scottish guidance.

Dr David Moore, BCSA Director of Engineering, said: "Although the Scottish Building Regulations are performance based and allow any safe method of design to be used, including a table of references to the withdrawn British Standards, if this change is implemented it will clarify their position as acceptable and safe methods of complying with the regulations."

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

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

Corus provides envelope solution for business park

Corus Panels and Profiles has supplied 10,500m^2 of its Trisomet 333 System to a new wholesale fruit facility at Priory Park Business Park in Kingston-upon-Hull.

Opened at the end of last year, the new park replaces a 200 year old fruit market in the city centre and has allowed 12 businesses to relocate.

According to sub-contractor L H Sleightholme, the Trisomet system lent itself to the project by virtue of its thermal and air tightness performance combined with speed of installation.

Lorenz Ethrington, Contracts Manager for L H Sleightholme, said: "We were able to minimise the visual impact of the finished scheme on the surrounding area by specifying Corus Colorcoat Verso in Heritage Green to ensure the development complimented and blended with the environment."

Manufactured in factory-controlled conditions, Trisomet 333 System is a robust, made to measure insulated roof and wall panel system that can be installed quickly and efficiently, bringing significant time and cost savings to any construction programme. A high performance building envelope solution comprising a spaced trapezoidal steel external skin, Trisomet provides optimum performance for water drainage, strength and walkability.

Contractor completes major rebrand

Robinson (formerly Robinson Construction) has successfully completed a major rebrand which it said will help secure its profile in this tough trading climate.

Managing Director John Robinson (pictured right) said: "As a family-owned company established for 50 years, we have built up an excellent reputation in the manufacture of steel structures. However, we continue to face unprecedented challenges in this recession, and therefore the Board was committed to under-pinning our brand, to not only maintain, but build our market share."

The company said it is delighted with the new brand image which has already been well received by customers and suppliers.

Using locally based Origination for the rebranding exercise, it said the new image conveys the company's values of expertise, quality, customer service and delivery in the fabrication and erection of steel structures.

Steel contractor makes renewables investment

Mabey Bridge has announced a £38M investment in a new facility which will allow the firm to become the biggest UK manufacturer of wind turbine towers, both for onshore and offshore applications.

The investment will result in 240 new skilled jobs to be based at Mabey Bridge's recently purchased 32,140m^2 industrial unit in Chepstow (pictured).

Peter Lloyd, Managing Director of Mabey Bridge, said: "This is a significant announcement which will provide a boost for both the national and local economy while supporting hundreds more jobs in the renewable energy sector.

"We are forecasting that production at the facility will provide around half the UK's requirement for wind turbine towers, greatly reducing the need for developers to import."

The new facility has been fully forward funded by parent company Mabey Holdings and will be capable of fabricating steel turbine tower sections up to 5m in diameter and 40m in length.

British Wind Energy Association Chief Executive Maria McCaffery MBE said: "This is tremendous news for South Wales but also for the UK as a whole. We are beginning to see the return of turbine manufacturing in the UK, making the low carbon economy a reality and bringing much needed jobs to local communities."

The factory will use the latest manufacturing techniques including computer controlled cutting and rolling, robotic welding, steel blasting and an automated painting facility.

Cannon Street Station redevelopment on time

Redevelopment work is progressing on schedule at one of London's busiest commuter stations.

Nearly 7,500t of structural steelwork will be erected by Watson Steel Structures at Cannon Street Station to construct a new eight-storey office building above the terminus concourse and tube station entrance.

Andrew Veness, Project Director for main contractor Laing O'Rourke said the main challenge so far has been demolishing the old 15-storey structure and then erecting the new steel frame while the station remains fully functional.

"Steel was the best solution for this project as we have complex cantilevers on two elevations, and the material offered us a lighter solution which has allowed us to bring steel to site piece-small as space is at a premium."

The new steel-framed structure sits above the station concourse on a concrete slab supported on four large steel columns which penetrate the station below. Space constraints have dictated that the four cores are being constructed from fabricated steel plates, and these are being erected progressively along with the main frame.

Developer for the project is Hines UK working in partnership with Network Rail. The entire development, which also includes the reconfiguration of the station itself, is scheduled for June 2011 completion.

Sustainability on course at college

North Wales based EvadX will be fabricating, supplying and erecting steelwork for ISG's £2.4M design and build project with Glyndwr University to build a highly sustainable creative industries teaching facility at its Wrexham campus.

Said to be one of the first buildings of its type in Wales and the North of England, the new two-storey, steel framed teaching block will support the University's provision of academic courses linked to the creative industries sector, across disciplines such as media, music, events and tourism and theatre production.

Designed to achieve an Excellent BREEAM environmental performance rating the building features a sculpted and sloping sedum roof, photo voltaic cells, rainwater harvesting and re-use and a ground source heat pump system.

Façade treatments include large areas of curtain walling, corium brick cladding and brise soleil to southern elevations, with ISG also carrying out a range of hard and soft landscaping across the site, as well as providing a number of secure bicycle storage areas and car parking spaces.

The project started in mid-February and is scheduled for completion towards the end of 2010.

NEWS IN BRIEF

Latest developments in the design and construction of **steel bridges** will be discussed at a half day event organised by the BCSA at London's Institute of Directors on 13 April. The conference will include topics such as Highways Agency Sector Schemes and new standards for railway bridge designs. Delegates will receive copies of the latest Eurocode design guidance for steel bridges. The conference will begin at 2pm and a buffet supper will follow at 6pm. The fee is £95 + VAT. To book, call 0207 839 8566 or visit *www.steelconstruction.org*

BRE Trust, the owner of BRE, has announced a new publication examining building users' behaviours and subsequent potential impact on energy efficiency. *"The Move to Low-carbon Design: Are Designers Taking the Needs of Building Users into Account?"* is available from *www.brebookshop.com* reference FB 21.

A consortium of five cladding manufacturers has selected **SCI** to develop new software for the assessment of wind loading for cladding design calculations. The wind load calculator (WLC) tool calculates dynamic pressures on walls and roofs using a full building approach to the assessment of load on each of the building surfaces. Location can be defined manually entering a UK National Grid Reference or by using an interactive map. The WLC calculates wind loads following Standards BS 6399-2 and EN 1991-1-4.

The wider use of stainless steel structures in the USA has been impeded by a lack of design guidance, leaving designers with the choice of conducting their own investigations or abandoning stainless steel in favour of alternative materials. To rectify this, **SCI** has been commissioned to prepare a design guide for welded and hot rolled stainless steel structural steelwork for publication by the **American Institute of Steel Construction (AISC)** as one of its series of Design Guides. The new guide will be based on current European stainless steel design guidance, but will be adapted to align to US design philosophy.

SCI teams up with academia

SCI and Oxford Brookes University (OBU) have joined forces to offer a new service to manufacturers of building products. The collaboration combines SCI's expertise in structural engineering and sustainability with OBU's expert knowledge of building physics and architecture.

The partnership will offer computer assessment of thermal details, whole building energy modelling, specialist structural analysis, including finite element modelling, and production of design data for building components and systems. It will also have access to a brand new structural and thermal testing laboratory situated on OBU's main campus.

SCI will continue to promote the 'SCI Assessed' scheme and will be looking to assist product manufacturers with the adoption of CE Marking in readiness for the introduction of the Construction Products Regulation in 2012.

To kick off the new partnership and to launch the new laboratory, OBU hosted the December 2009 meeting of the Metal Cladding and Roofing Manufacturers Association. The event, which was attended by over 40 delegates, gave the UK's leading cladding manufacturers the opportunity to view the facilities and discuss their requirements with SCI and OBU staff.

New machine improves fabricator's efficiency

Billington Holdings has invested in a new combined Peddinghaus CNC sawing, drilling and marking machine for its Yate facility near Bristol.

The company said the CNC unit will improve on the efficiency and cost of delivery of projects, by producing steel 50% faster as well as producing three times as many heavy steel beams than its previous machine.

Recently launched on the market by Peddinghaus, the machine is said to enable the drilling of structural steel sections using carbide tooling technology at much increased rates of throughput.

Kevin Campbell, Production Director said, the purchase of the machine is a long standing commitment to Yate and ensures that structural steel will continue to be manufactured in the region.

"The installation and commissioning process has been the smoothest we have ever experienced and the machine is the most productive we have ever had."

Investment in new fire protection facility

International Paint will invest £6.2M to build a new testing laboratory for fire protection products at its manufacturing site in Gateshead, Tyne & Wear. The company said the steel framed facility, which is scheduled to be completed in early 2011, will create 14 new jobs, and secure a further 30 at the site.

"This facility will significantly improve our ability to satisfy our customers' current and future fire protection requirements," said Dipak Mistry, Technical Manager for International Paint's Protective Coatings business.

"The laboratory will form part of a state-of-the-art centre of excellence for fire protection. Our intention is to bring new products to the market faster and drive the improvement of fire protection in the industry."

Diary

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

4 March 2010
Steel Building Design to EC3
Gloucester

11 March 2010
ISE Stability of Steel Framed Buildings
Joint with ISE/London

18 March 2010
EC4 Composite Design
Birmingham

23 March 2010
Steel Building Design to EC3
Darlington

30 March 2010
Steel Building Design to EC3
Edinburgh

13 April 2010
Steel Connection Design
Glasgow

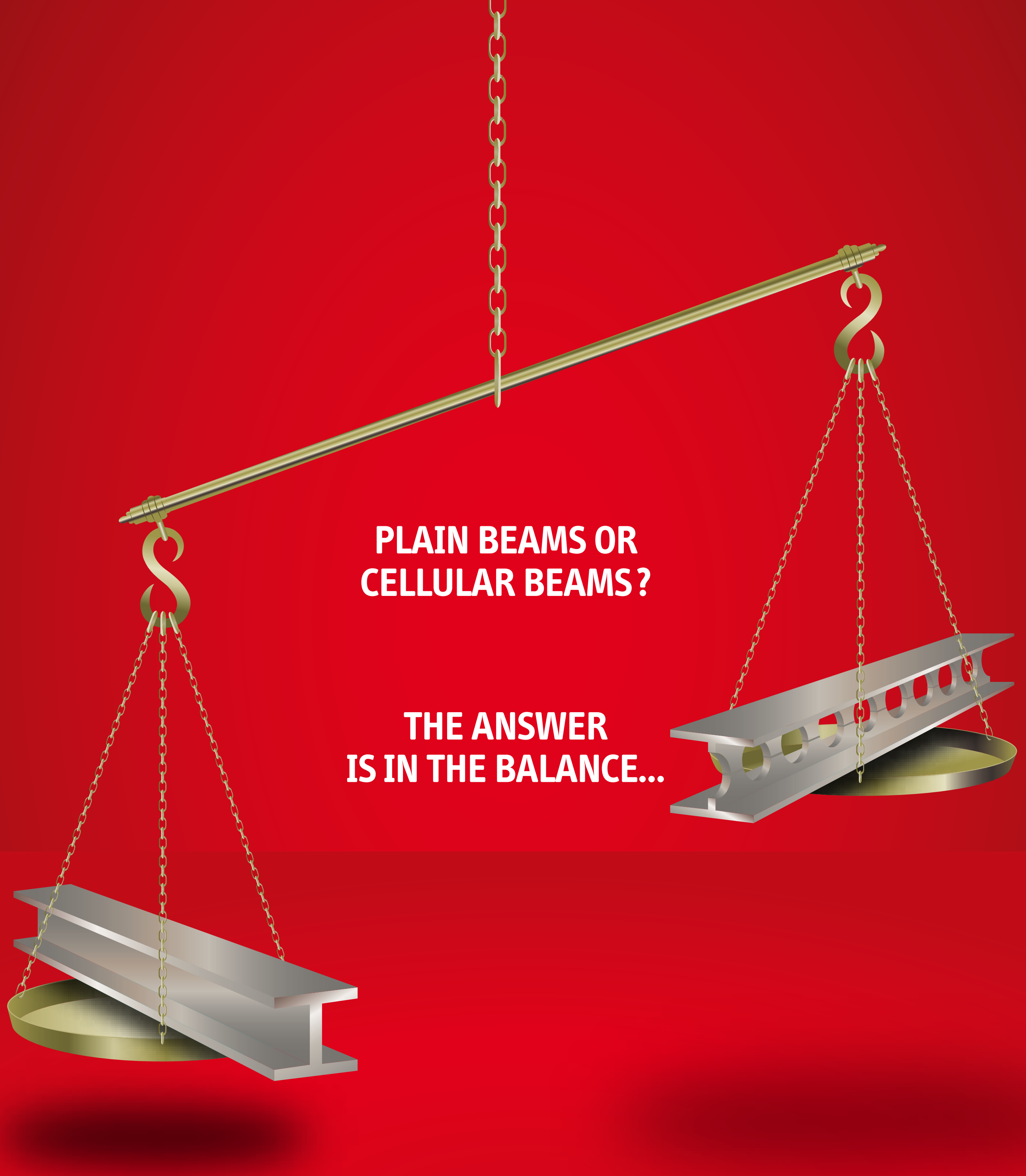
13 April 2010
Steel Bridges Conference
Half day conference, pm
Institute of Directors, London

20 April 2010
Steel Connection Design
ISE, London

20 April 2010
Portal Frame Design
Coventry

27 April 2010
Steel Building Design to EC3
Newcastle

29 April 2010
Floor Vibrations
Oxford


PLAIN BEAMS OR
CELLULAR BEAMS?
THE ANSWER
IS IN THE BALANCE...

Automation framed in steel

The British Library's recently opened storage facility combines cutting edge technologies to offer shelf space for seven million items from the UK national collection. NSC reports from a steel-framed structure with a difference.

Above: Steel architectural adornments conceal the building's risers

It has been described as the world's most advanced library storage facility, with a capacity to house approximately 7 million items from the British Library's national collection on 262km of temperature and humidity controlled storage space, all housed within a large steel-framed structure.

Known as the British Library Additional Storage Building (ASB), it was recently opened on a site at Boston Spa, near Wetherby in West Yorkshire. The fully-automated building will house low-use material including patent specifications, books, serials and newspapers in 144,000 storage containers of three different sizes.

To give some idea of how the facility works, when users of the British Library's main St Pancras Reading Rooms in London order a particular item that is stored at the ASB, the automated system, which has seven robotic cranes, will identify the bar coded container holding the document and bring it to a library operator for retrieval. The item will then be dispatched to St Pancras where the applicant will be able to inspect it within 48 hours of ordering.

The project was funded by a £26M grant from the Department of Culture, Media and Sport, and is intended to address the pressure for storage space at the British Library's London facility, as the collection is expanding at a rate of 12.5km of linear shelf space per year.

With a huge amount of racking needed to hold the items - weighing hundreds of tonnes - which was assembled inside the structure once it was erected, one of the initial construction challenges was to get the foundations installed. The racking alone is heavy, but once full of documents the overall weight could be tripled in some areas.

The British Library's collection is expanding at the rate of 12.5km of linear shelf space per year.

In order to eliminate differential settlement and keep the building perfectly level, the racking system is supported by a 350mm thick, super-flat steel fibre reinforced floor slab which acts as a raft.

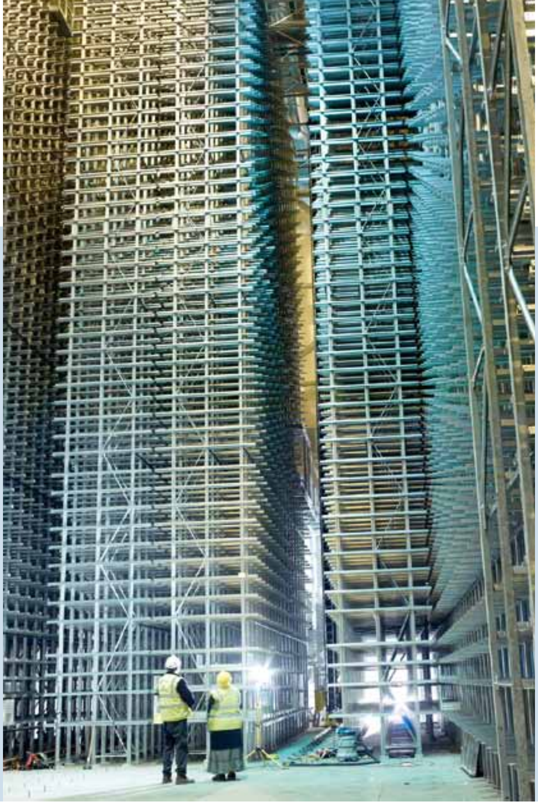
"The foundations were heavily reinforced but simple in construction," says Terry Cocker, Allenbuild Construction Manager. "They have top and bottom steel bars forming a cage."

Overall the foundations are strip foundations directly onto the excavated stone, and these were only 900mm deep by 1,500mm wide, with pad foundations to the intermediate steel.

Allenbuild began working on the previously greenfield site in June 2006 and completed its work towards the end of 2008. The British Library then undertook a 12 month fit-out programme which included the installation of the racking system which was supplied by specialist firm FKI Logistex.

The main steel frame for the ASB was fully erected over a three month period by James Killelea and Co. The main frame measures approximately

FACT FILE
British Library Additional Storage Building, Boston Spa, West Yorkshire
Client: *British Library*
Architect: *Atkins*
Main contractor: *Allenbuild*
Project Manager: *Capita Symonds*
Structural engineer: *Atkins*
Steelwork contractor: *James Killelea*
Steel tonnage: *800t*



Features abound in the high-tech auto library

The project has a number of cutting edge technologies to keep the important books and documents safe and sound for posterity. The structure is the first of its kind to incorporate automated storage and retrieval systems (left), optimum environmental controls, and pioneering low-oxygen fire prevention technology in a single building.

Although sprinklers are usually the preferred solution for libraries (wet books can be freeze dried) the ASB has adopted a low-oxygen system of fire prevention which allows oxygen levels to be kept to just 14.8% as fires can only occur if oxygen levels are at 17% or above.

To support this, the building is also one of the most air-tight in the UK with a leakage rate specification of not more than 0.5m^3 of air per square metre of wall per hour.

Other notable features include the air conditioning system which maintains a controlled microbe free climate at a constant temperature of 16°C and constant humidity of 52%.

83m long x 50m wide with a height of 24m. It has an 18m x 50m raised services support building at one end and also plant service structures down the full length of each side along with tower riser structures which are used to feed the internal ducting. All of this required 800t of structural steelwork which amounted to more than 6,500 hot rolled members.

To allow the racking system to be installed, the main frame had two access doors built into the steelwork. Once the fit-out procedure was complete these doorways were in-filled with steelwork and clad over.

A steel frame was chosen for a number of reasons, says Paul Terry, Capita Symonds Director. "We looked at other materials, but a steel frame won on cost and speed of construction."

One of the main stipulations for the ASB was the requirement for large spans to house the racking system. To that end the structure has an 18m span and a 24m span, separated by one row of internal columns. Because of the building's height (24m), all columns were brought to site in two sections of 11m each, and bolted together on site. Because of the column's height, temporary steelwork was needed to provide stability while the connecting cross members were installed.

"To span and form the structure's roof we used 2m deep plate girder beams," explains James Killelea Contracts Manager Bob Allan. "As well as circular holes or service ducts these large girders also had rectangular holes to allow access through the girders along the underslung maintenance walkways."

These maintenance walkways thread their way through the girders and span the entire length of the structure.

The large steel frame gets its stability from cross bracing located around the building's perimeter, while an attached two-storey administrative block, located above a loading bay, is formed by a more traditional beam and column method.

Summing up the successful completion of the project, Steve Morris, Director of Finance and Corporate Services at the British Library, says: "The design and construction of the ASB has been a huge task, involving Library staff along with external providers. It is tremendously gratifying to see the building functioning as designed."

Capita Symonds had been involved with the ASB project since 2003 when the team carried out the initial feasibility study. Mr Terry comments: "It is great to have developed through the many stages a working solution which achieves a change in the approach to the storage and retrieval of important documents."

Left: Plate girders for the roof were brought to site in 22m lengths

Below: The rooftop girders have underslung maintenance walkways attached

Steel crown for the Cube

Birmingham's most prestigious mixed use development features a geometrically challenging steel roof structure as well as an eye-catching fretwork screen along one elevation.

Above: The rooftop's distinctive corner wings will be fully glazed

FACT FILE
The Cube, Birmingham
Main Client: Birmingham Development Company
Architect: MAKE
Main contractor: BuildAbility
Structural engineer: Buro Happold
Steelwork contractor: Bourne Special Projects
Steel tonnage: 320t

There is nothing quite like making a bold statement with a new and exciting building, particularly one in a prime city centre location. This is the case with The Cube, the UK's largest mixed use building and a structure which is set to enhance Birmingham's most desirable location to live, work and shop.

Due for completion later this year, The Cube represents the final phase of The Mailbox development, a large inner city scheme which has transformed a former industrial site into an area of canalside restaurants, bars, shops, offices, houses and apartments.

So what makes The Cube stand-out? Its size to start with, it has 25 floors in total making it the tallest building in the vicinity. Secondly, the eye-catching bronze and aluminium cladding and its shape of course.

As the name suggests, the building is shaped like a cube, albeit with only three and half habitable elevations constructed around a largely open and hollow central core. Completing the four sided cube shape, the structure's north western side stops at level 12 and from here upwards to the top of the building a steel fretwork screen spans the 52m wide elevation. The fretwork is not solid and allows daylight to penetrate into the central part of the building.

Below: The fretwork is connected to the structure's floor slabs

> **"Steel box sections were selected for the fretwork screen due to the complex geometry, large spans and torsion transfer."**

The fretwork resembles a very large game of tetris (the 1990s computer game) and is made up of a series of irregular shaped pieces of steelwork, most of which have two 45 degree angles at either end. These pieces are made from fabricated 400mm x 400mm box sections, with the heaviest weighing close to 5t.

Brought to site in various sized pieces the fret was erected from the bottom up, with scaffolding providing some temporary support. At either end the fretwork has pin connections to the building's concrete slabs, with some of these moment joints which relieve potential thermal expansion.

As the giant jigsaw fretwork was erected upwards, the scaffolding - needed for the installation of the cladding which covers the fret and mirrors the exterior of the rest of the building - was also erected.

Each fretwork section was brought to site complete and then bolted to the adjacent member with special tension control bolts. Manoeuvrering these sections into position proved to be quite challenging, as Bourne Special Projects Director Howard Cox explains. "Because of the variety of shapes it was difficult to find the section's centre of gravity when lifted from the delivery truck by crane.

"Many of these steel pieces had to be re-slung prior to being lifted into place within the fretwork pattern. Just like the computer game, only somewhat heavier."

Along the topmost level of the fretwork a fabricated truss spans the void, made from a total of four 300mm x 300mm box sections. The truss provides lateral stability to the connected fretwork screen below, while vertical loads are all transferred via zig-zag paths to the concrete slabs.

"Steel box sections were selected for the fret-work screen due to the complex geometry, large spans and torsion transfer," explains Simon Walker, Engineer for Buro Happold. "It was also necessary to keep the weight of the fretwork down to a mini-mum as it is supported off the concrete slabs."

Apart from the spectacular looking fretwork screen The Cube is essentially a concrete structure from ground floor to the 23rd floor. These levels accommodate shops, apartments and offices (see

Above: The complex fretwork screen has been likened to a 1990s computer game

box), but above this forming the 24th and 25th floors the building is crowned with a two-storey steel structure.

Accommodating a rooftop restaurant and a hotel, the steel structure has proven to be one of the most challenging aspects of the entire project. But why change from concrete to steel for the topmost two floors of The Cube?

Simon Walker, Engineer for Buro Happold says: "The top floor restaurant's elevations are nearly all glazed, while the hotel below has some large glazed areas. We selected steel for these two floors due to the complexity of the glazing. Also, architecturally these levels needed to look different and stand out."

Topping three sides of the structure, the two-storey high steel crown features four overhanging wings, one in each of the building's four corners. Formed with box sections in the larger northern tips and UC sections in the southern tips, the wings were welded together on site from fabricated pieces.

"The geometry for these areas is very complex and the design model had to be shared among the entire project team to get it right," says Mr Cox. "This sort of complex shape featuring numerous angles could probably never have been done without the aid of 3D computer design programmes."

Because of the site's tower crane's weight limitations the wing sections had to be brought to site in pieces of no more than 7t. These heavy sections had then to be joined together by high precision welding to maintain the overall geometry. Great care was taken to ensure that the glazing and cladding lines rising from the concrete frame part of the structure integrated with that from the steel frame at these locations.

The remainder of the steel structure is a composite design with exposed CHS columns lending the areas an architectural highlight and stability derived from concrete cores.

One elevation had to be substantially 'beefed up' as it features a 3m cantilever which will accommodate restaurant windows. Heavier 600mm deep plate girders are installed here as the roof above supports the building's window cleaning machine.

Weighing approximately 20t, with a reach of 20m, the machine runs along a track and can reach and clean all of the structure's windows.

The steelwork package was completed by Christmas and currently secondary steelwork, onto which cladding will be fixed, is being installed around the upper levels of the building.

The Cube's character has emerged with the completion of the fretwork, while the steel and glass angular rooftop structure adds and enhances the structure's overall architectural appearance.

The cubist vision

The Cube has been described as Birmingham's most spectacular building and has already achieved a BREEAM Excellent rating. A number of innovations and firsts are included in the structure's make-up, with the lower levels up to fourth floor containing an automated stacking car park system. Above this on levels five to eight there will be an array of designer retail outlets, while levels nine to 14 will offer approximately 10,000m^2 of prime office space. Levels 15 to 22 will consist of 244 apartments, and then above this on the upper most two floors there will be a boutique hotel and Birmingham's first rooftop restaurant.

FACT FILE
Scunthorpe schools BSF
Main client: *North Lincolnshire Council*
Architect: *NPS*
Main contractor: *May Gurney*
Structural engineer: *May Gurney Structural Engineers*
Steelwork contractor: *Atlas Ward Structures*
Steel tonnage: *1,050t*

Bright future provided by steel framed schools

Steel sourced from Corus, which has a large manufacturing plant at Scunthorpe, is making a substantial local impact by being used to construct two new schools in the Lincolnshire town. Martin Cooper reports from the first phase of an ambitious BSF project.

One construction sector which has been left relatively unscathed during the recent credit crunch and downturn is education. A raft of Government and privately financed schemes are either completed or on-going as the nation's schools and colleges get an overdue make-over.

Many of these rebuilt or new educational establishments rely on steel as their main framing material, as clients, contractors, designers and architects realise the myriad of benefits afforded by steel construction - speed, cost and flexibility being just three.

Corus is the UK's largest steel producer and when a £91M Building Schools for the Future (BSF) programme for the town was put out to tender, there was a strong desire to use locally produced material.

As it turns out, the consortium which is undertaking the programme, which will eventually involve the construction of one new school and the refurbishment of five others, chose steel framed structures as one of the main elements of its successful bid.

"Steel offers a quicker construction programme and we specified from the outset that all of the material had to be sourced locally by our steelwork subcontractor," says Gary Reay, May Gurney's Senior Project Manager for Melior Community College.

Melior is one of two projects currently under way as part of Scunthorpe's BSF programme, the other being Brumby Engineering College (four more schools are due to start later this year).

The construction of the £18M Melior Community College represents the first new build secondary school in Scunthorpe for more than 50 years and the project is the largest scheme in the programme. Combining two existing schools - Thomas Sumpter and South Leys - the new school will focus on business, enterprise and the arts.

Main contractor May Gurney has been on this site since October 2009, with the initial works on this greenfield site including a cut and fill operation to level the sloping topography.

The project has two phases, with the initial phase consisting of the construction of the 8,500m^2 new school building and its associated landscaping. During the summer of 2011, the pupils will decamp into their new premises and May Gurney will begin demolishing the adjacent Thomas Sumpter School to make way for new sports pitches.

The majority of the new school is a two-storey

Above: Steel deliveries to Melior are made outside of the morning and afternoon rush hours

Above: How the completed Melior Community College will look

Above: CHS columns support Brumby's signature wave-form roof

braced steel with precast planks design, with Atlas Ward Structures fabricating, supplying and erecting the steelwork - all sourced from Corus - during a 15 week on-site programme.

Steel's flexibility has also played a key role in the design of Melior, says May Gurney's Principal Design Engineer Tim Brown. "A number of teaching and vocational areas are sub-divided by folding partitions which can be removed if and when larger areas are required by the school.

"Also, in the middle of the school's two teaching blocks there are central voids and atriums which have been designed so they can provide future extra floorspace."

Service integration was another key issue and consequently 530mm deep cellular beams will be installed in the majority of the teaching and administrative areas. Specially fabricated cellular beams with elongated openings, to accept larger services, will be installed around the school's plant areas.

The majority of the school's soffits are to be exposed to facilitate cooling and natural ventilation, thereby making the structure more economical as fewer air-conditioning units are needed.

"There are a few tricky connections associated with the job and as there are exposed soffits some of our connections will also be left exposed. We had to make sure the fine details on these were perfect," says Neil Hall Project Manager for Atlas Ward.

Most of the steelwork is based around a 3.6m grid pattern with the exception of the large open column free areas, such as the sports hall, drama hall and the central focal point of the whole school, the forum.

"We specified from the outset that all of the material had to be sourced locally by our steelwork subcontractor."

The forum is a triangular area that provides links with all four wings of the school learning spaces. A great deal of thought has gone into how to maximise the potential of the zone at the heart of the school. It will accommodate an assembly area, a dining hall and demountable seating for students to view performances in the adjoining drama hall. The forum features some of the project's longest spans with 18m long cellular beams to be installed.

Brumby Engineering College

Meanwhile, less than two miles across town work has also started on the £12M Brumby Engineering College. This project involves the partial demolition

Work on schedule despite bad weather

In order to start the steel frame erection on Melior Community College on time, Gary Reay, Senior Project Manager for May Gurney, says his team started work two weeks ahead of schedule despite this winter's heavy snow.

However, some ingenious measures had to be taken to make sure everything remained on track.

"The problem wasn't the snow but the sub-zero temperatures," says Mr Reay. "We had to encapsulate the concrete substructures with temporary tents and introduce heaters to maintain a constant temperature for concrete curing."

Without these measures to mitigate the harsh weather the follow-on steel erection programme would not have started on time.

Above: Cellular beams for service integration are being used for the majority of Melior's main frame

of the existing school, the construction of replacement structures and the refurbishment of the remaining old school buildings.

As the new buildings on this project are being built on areas previously occupied by old school structures, a phased programme is in operation which allows Brumby College to operate normally. Some temporary classrooms were installed by May Gurney at the beginning of works programme last year.

Structural engineer for the job, May Gurney, says steel was again the best solution for this project because of the need for a speedy construction programme.

The new buildings on this project include a new stand-alone steel framed sports hall which was erected towards the end of last year, and a large L-shaped main building which is a two-storey steel braced structure. The north south elevation of this building is curved in plan, adding some complex geometry to the job.

The main L-shaped structure's most eye-catching element is the wave-form roof which extends along the main part of the building and is supported on a series of CHS columns. This steel structure is formed with curved UKC's, bent by Barnshaw Section Benders, and then fabricated and erected by Atlas Ward.

This block contains a dining hall, a drama room, a plant room, a science block and a technology block.

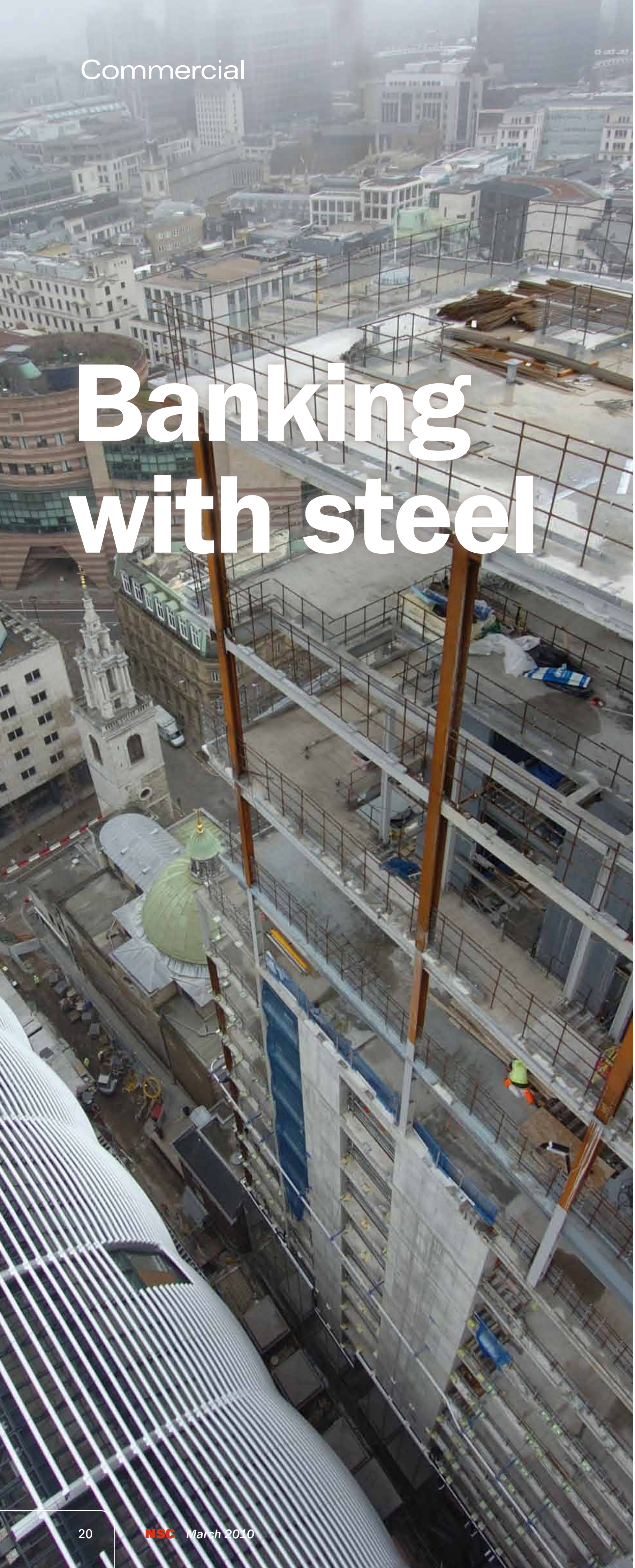
"The design of this project is similar to Melior with exposed soffits and steelwork connections, with bracing predominantly located in partition walls or along exterior areas with no windows," says Mr Hall.

Steel was again the best solution for this project because of the need for a speedy construction programme

One of the largest steelwork sections on the job is a large 28.8m long x 2.5m deep truss which is located along one elevation in the dining hall. This is the area where the wave-form roof adjoins a more traditional flat roof on the east west part of the L-shape. The truss is positioned at roof level and allows one dining hall elevation with large windows to be column free.

Both Melior Community College and the new buildings at Brumby Engineering College are scheduled to be in use by mid-2011.

Below: Impression of the completed Brumby Engineering College



Banking with steel

A steel frame along with a Bi-Steel core with the strongest panels ever erected are helping a new commercial development for a banking institution achieve its desired architectural vision. Martin Cooper reports.

One of the latest additions to the City of London's skyline is a new headquarters building for merchant bank Rothschild. Situated roughly halfway between the Bank of England and Cannon Street Railway Station on St Swithin's Lane, the new 16-storey building will allow the bank to bring together all of its London employees.

The redevelopment - Rothschilds third building on the site since it moved to London during the Napoleonic Wars - is the first UK project to be designed by Pritzker prize-winning architect Rem Koolhaas.

His design has taken into account the confined and historic site with a double height glass ground floor entrance area that will open up pedestrian views to the Christopher Wren Church of St Stephen Walbrook and its churchyard, creating a transparency previously unheard of in this part of the City.

As with many commercial developments in the Square Mile, Rothschilds new headquarters is a steel-framed structure, braced and deriving the majority of its stability from cores. The speed and ease of construction in a city centre site means steel is usually the favoured framing material for such projects.

The desired open plan entrance area, with the aforementioned views of the adjacent church, lead the designers to incorporate a number of steelwork features. Firstly a large storey high transfer truss spans one elevation of the structure at ground floor. Spanning a basement loading bay, the truss

Left: The proximity of the adjacent building meant the L-shaped core had to be assembled from inside New Court's footprint

Top left: A 3m high x 13m long truss for the second floor was brought to site in one piece
Top centre: The top floor will house an open plan conference room
Above: Externally clad view of New Court
Left: Rothschild's new headquarters will be the third building it has owned on this site

"Bi-Steel cores take up less space than equivalent strength concrete cores."

FACT FILE
New Court, City of London
Main client: *Rothschild Bank*
Developer: *Stanhope*
Architect: *Allies and Morrison*
Main contractor: *Bovis Lend Lease*
Structural engineer: *Arup*
Steelwork contractor: *Rowen Structures*
Steel tonnage: *1,900t*
Bi-steel tonnage: *300t*

supports a main column that in turn supports 15 upper storeys and also opens up the ground floor entrance lobby, by removing column lines.

"Architectural limitations on steelwork sizes led us to use very heavy fabricated members for this truss," explains Andrew Henstock, Rowen Structures Project Manager. "This meant we had site welded joints for the internal members to the booms."

As the truss was site welded the erection sequence was critical and a temporary works scheme was provided that checked the load paths as each piece was added.

With these design requirements Rowen had to bring the truss to site piece-small as the on-site tower crane didn't have the capacity to lift the truss into place as one completed section.

The truss, which is 4m deep and spans 15m, was brought to site in 12 pieces. This consisted of the top boom in three sections, the bottom boom in one section, plus eight diagonal members. The top boom of the truss is 400mm x 400mm and fabricated from 100mm thick plate, while the bottom boom has identical dimensions but is made from thinner 45mm plate.

"The architectural concept for the building is a central cube that is served by three annexes. The main space that forms the cube is interrupted by only four internal columns – consequently all structural elements have been pushed to the periphery of the building – including the cores. The eccentricity of the architectural plan meant that we needed additional stiffness – using Bi-steel provided this while allowing us to reduce the number of internal structural walls," says Andrew Grant, Arup Project Engineer.

Above: The upper levels of the project's second core have been constructed with Corus Bi-Steel panels

An L-shaped core (see box story) begins at ground floor level and rises 54m to the structure's 10th floor. On this level the building's floorplate decreases and the project's other core carries on by itself to the building's level 15, but with one major change. This core starts at ground floor as a concrete structure, but from level 11 to 15, it is a Bi-Steel core containing two lift shafts.

"As the upper levels are smaller there was a need to preserve as much floorspace as possible and Bi-Steel cores take up less space than equivalent strength concrete cores," explains Corus Bi-Steel Principal Engineer Chris Beattie.

Both of the Bi-Steel cores were erected at the same time as the structure's main steel frame, which saved time and resources.

All of the building's floors feature Fabsec cellular beams to help maximise the structural void and create maximum floor to ceiling heights. As there was a stipulation to keep the floor depths to a minimum all connections are via thick column flanges which made the design tricky. 'We had to ensure that the beams could be erected without any bolt clashes," explains Mr Henstock.

The central element of the tower will be clad in clear glazed curtain walling, but the cladding to the annexes will have a metal mesh integrated into the glass that, combined with the aluminium, will give the building a solid metallic feel.

To accommodate the glazing and the architectural vision, the majority of the perimeter columns are located within the façade and needed to be very slender. To achieve this 200mm x 200mm fabricated SHS columns are used above first floor, while 250mm x 250mm SHS columns, concrete filled for robustness and fire protection, are used at ground level.

The 200mm x 200mm SHS columns have site bolted cap plates and base plate splice connections to incorporate primary and secondary moment effects.

"This proved extremely challenging to incorporate," says Mr Henstock. "As the dead load on the structure decreased the net tension values increased significantly and this lead to some details being fully welded to ensure that the loads could be developed."

The building is scheduled for completion this summer.

Project takes strongest Corus Bi-Steel Panels

The project's L-shaped Bi-Steel core has panels for its lower two layers made from 20mm thick plate, which represents the strongest panels Corus has ever supplied for a building core. The plate decreases to 8mm plate for the upper five layers where the strength and stiffness requirements are reduced. Bi-Steel consists of two plates connected together by an array of friction-welded bars. The space between the plates is filled with concrete on site to produce a very strong composite core system.

The concrete filled void on this core stays constant at 300mm thick for its full 54m height.

The panels and corner module typically measured 2m wide by 7.8m high and were filled after each layer was erected.

"On the lower part of the core there are some large loads coming from a supported transfer truss," explains Corus Bi-Steel Principal Engineer Chris Beattie. "Thick plate was needed to maintain the core's stiffness."

This core is also located along an elevation that is under a metre away from the adjacent building. With no room to erect the core from outside of the project's footprint, it was erected from the inside, something that would not have been achieved with a typical mechanised concrete core system.

The core was erected at the same time as the main steel frame meaning construction of the steel frame could start sooner particularly with regard to the critical area of getting out of the ground.

The panels for the core were designed and manufactured by Corus and then delivered to Rowen Structures. Rowen designed and detailed the beam connections and completed the fabrication works, including drawings, utilising its in-house expertise gained from having used Bi-Steel previously.

Above: Bi-Steel panels being installed to form the basement levels of the New Court L-shaped core
Below: The 54 metre (10 storey) L- shaped Bi-Steel core

Stadium kicks off regeneration

FACT FILE
B2net Stadium, Chesterfield
Main client: *Chesterfield FC*
Architect: *Ward McHugh Associates*
Main contractor: *GB Building Solutions*
Structural engineer: *Opus International*
Steelwork contractor: *Robinson*
Steel tonnage: *730t*

A former glassworks site in Chesterfield is the main focus for a large regeneration scheme which has a new football stadium as its centrepiece.

Above: The stadium forms part of the much wider A61 Corridor regeneration programme

Below: Curved cellular beams form the roofs of the two main stands

Chesterfield is the latest Football League club to invest in a new all-seater stadium to replace an outdated Victorian era ground. The club, nicknamed The Spireites, has played at its current Saltergate home since the 1870s and although the stadium has been modified over the years, it is deemed woefully inadequate for today's higher profile game.

Currently under construction and scheduled for completion in time for the 2010/11 season, the new B2net Stadium will have a 10,338-seat capacity along with a host of other facilities associated with a modern sporting arena.

The site, previously occupied by the Dema Glass factory which closed down in 2001, forms part of Chesterfield's A61 Corridor regeneration programme. Also on the site is a new 12,700m^2 Tesco superstore which opened last year and a host of small mixed-use business units, all of which are providing a significant boost to the local economy.

The B2net Stadium is being built by GB Building Solutions, with the project's structural steelwork and precast terracing supplied and erected by Robinson.

The stadium's four structurally independent stands are all single tier and have been formed with steel rakers and columns supporting precast terracing units, while the roofs are formed by a series of 15m-long cantilevered Westok rafters.

"This is generally the way modern stadiums are built today," says Paul Jones, Opus International Project Engineer. "Steel lends itself to a more economical solution as well as a quicker construction programme."

"Steel lends itself to a more economical solution as well as a quicker construction programme."

The stadium's Main or West Stand incorporates conference facilities and banqueting rooms, and to accommodate this Robinson has erected a traditional two-storey column and beam composite area behind the stand's terracing.

Erected around a 7.5m x 7.5m grid pattern, the ground floor will house concourses, bars, ticketing and administrative offices, as well as home and away team facilities. Above this on the first floor level there was a need for larger column free space - for the conference room and hospitality suites - so a central column line has been omitted giving the area 14m clear spans.

On the opposite side of the stadium, the East Stand has a similar two-storey structure behind its

Top: Steel construction has kept the project on schedule despite the harsh winter

terracing and this will house a multi-purpose sports and community room, sports injury clinic, meeting rooms as well as a classroom resource centre for local education.

The steel cantilevered roofs over these two stands are curved, and this has been formed by erecting each cantilvered Westok beam incrementally higher than the previous member. This process was repeated until a central point on the roof was reached, whereby the sequence was reversed all the way down to the other end of the structure.

Behind both of the goals, the North and South stands consist solely of terracing with ground level concourses and vomitories leading into the seating areas. The cantilevered roofs over these two structures have been erected without the curved profile.

Rob McGann, Robinson Contracts Manager says: "We've erected 730t of structural steelwork on this project which included metal decking to the back of house areas, terrace rakers and the beams to form the stand's roofs. Our contract, which also included installing the precast terrace units, was completed within the agreed 12 week programme."

Prior to the steelwork commencing, towards the back end of last year, main contractor GB Building Solutions had to undertake a thorough site remediation of this brownfield site. After a cement stabilisation programme pad foundations were installed to accept the structural steelwork.

Despite the recent harsh winter conditions John Currie, GB Building Solutions Project Manager, says good progress was made by the entire team during January and the structural steelwork and precast terraces were completed on time. "This eliminated a good proportion of the delivery vehicles coming on site."

Another important milestone was reached during February as the four corner floodlights were erected.

Externally the stadium's elevations will feature a mixture of masonry, cladding and large glazed areas, while the roofs will have a standing seam metal profile. The exception to this will be the West Stand, which will have a clear transparent polycarbonite section to its roof to allow natural daylight to shine directly onto the pitch.

Summing up Mr Currie says: "In early March work will start in earnest on the pitch and this process will run right through until July in preparation for the club's first game in its new stadium."

Below: The majority of the steelwork was erected by cranes positioned on the pitch

Poised for World Cup duty

Chesterfield's B2net Stadium could be used as a training base for one of the World Cup teams if England's bid to stage the 2018 tournament is successful.

The stadium is part of Sheffield's successful bid to be one of the 12 host cities, and a country drawn to play at the Hillsborough Stadium will be assigned a local training venue, one of which is Chesterfield's B2net.

Chesterfield FC Chairman Barrie Hubbard says: "We were part of Sheffield and Derby's bid to be host cities. Derby missed out but Sheffield is still in the running and if FIFA decides later this year that the 2018 World Cup is to be held in England, our stadium could be a training venue."

All change at Newport station

As part of a city wide regeneration masterplan, Newport railway station is currently being redesigned to provide a striking civic building with steel playing a significant role in the design.

Below: Once the footbridge was installed work began on the two terminus structures

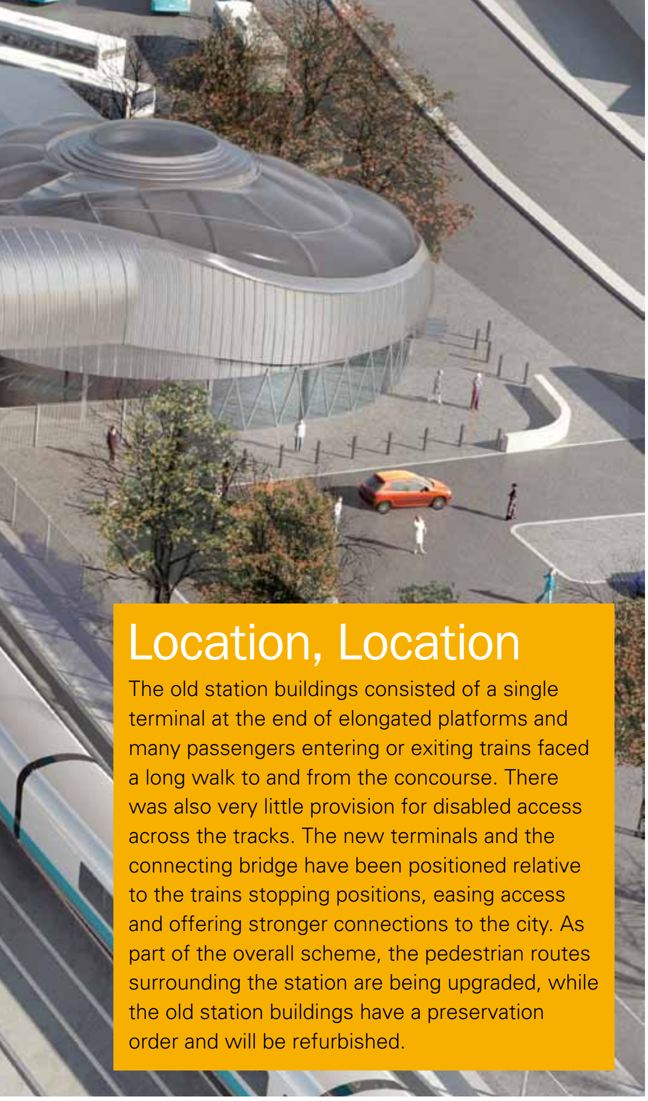
Newport in Monmouthshire is widely regarded as the gateway to South Wales and is the first major conurbation visitors encounter after crossing the River Severn. In order to bolster this reputation and part of a large regeneration project, the city's railway station is in the midst of a radical transformation. Designed by an Atkins Grimshaw partnership, the new station has an organic spiraling look and consists of two terminals linked by a central footbridge.

The city is bisected by railway tracks and as a result, each half of Newport has developed its own character. The design for the new station is said to embrace this divide by creating two terminals; the north terminal which is on the civic side of the city and will focus on the needs of commuters and a south terminal on the commercial side catering more for tourists and daytrippers.

"The footbridge was always going to be a steel structure because of the spans and its ability to achieve the organic form we were seeking."

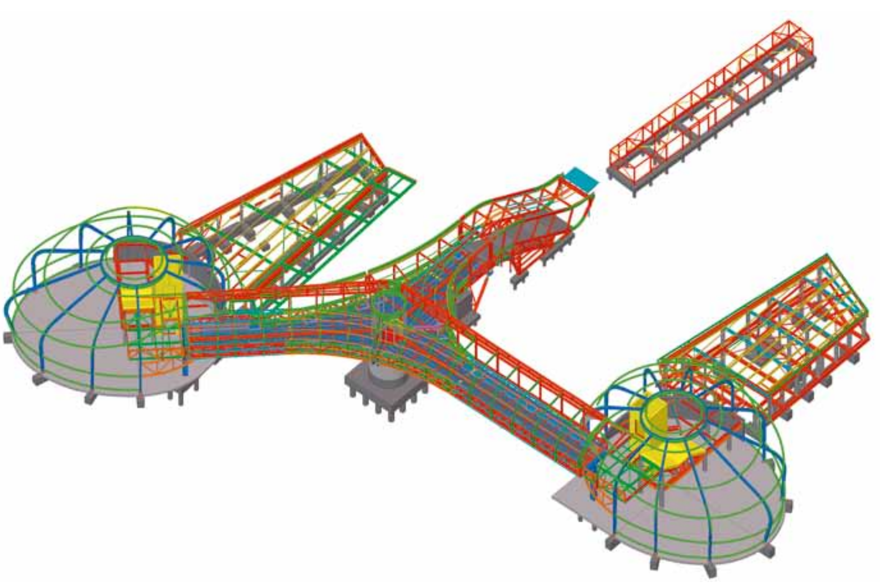
Ticket facilities and platform access are split equally between the two terminals, and these along with the linking footbridge are housed within continuous ETFE and aluminium clad spirals. The use of an ETFE wrap over a steel structure not only creates a very bright and airy space but also, due to the lightness of the material, the structure requires minimal support.

Chris Pembridge, Atkins Regional Director, says this was one of the reasons why steel was chosen as the main framing material. "We looked at timber



Location, Location

The old station buildings consisted of a single terminal at the end of elongated platforms and many passengers entering or exiting trains faced a long walk to and from the concourse. There was also very little provision for disabled access across the tracks. The new terminals and the connecting bridge have been positioned relative to the trains stopping positions, easing access and offering stronger connections to the city. As part of the overall scheme, the pedestrian routes surrounding the station are being upgraded, while the old station buildings have a preservation order and will be refurbished.



Top: Model of steel structure

Above: Christmas provided the ideal time to take posession of the railway and install the footbridge

and concrete for the terminals but went for steel for its ease of construction as well as it lightness. The footbridge on the other hand was always going to be a steel structure because of the spans and its ability to achieve the organic form we were seeking."

Linking the two terminals and allowing access to a central pair of platforms, the bridge has three spans and gains its stability from a central support containing a concrete lift core. The span from the north terminal to the central core is 23m, while from the south the span is 29m. The reason for this disparity being the bridge's organic curving shape. A third, and much shorter span allows access, from the middle of the bridge and liftshaft, to the central staircase leading to the platforms.

Steelwork contractor SH Structures fabricated and then delivered the footbridge decks to site in six sections.

"Each span came to site in two halves, with a splice down the middle," explains Dave Perry, SH Structures Contracts Manager. "The longest sections were 29m long, but as the section's were nearly 5m wide we had to bring the loads to site on special bogies and get escorted."

Once on site each of the spans were assembled using a combination of welded and bolted connections, along the roofs, which consist of a series of RHS sections. Much of the cladding, glazing and ETFE was also installed prior to the complete spans being lifted into place during a 55 hour rail possession over the Christmas period.

By assembling as much of the footbridge as possible and then lifting completed sections into place the contractor minimised working at height and reduced the need for further rail possessions.

Prior to the lifting operation a central support steel ring beam, which sits on top of a concrete lift shaft was installed. This provides the spans with their central support, while at the north and south ends two 6m-high T-columns - made from 500mm x 500mm fabricated box sections - had also been installed.

By erecting the footbridges first the project team were able to place the cranes on the vacant footprints of the terminal buildings. Once the spans were up and lifting equipment offsite, work commenced on the foundations for the two terminals.

The two terminal buildings are essentially portal frames, albeit in a circular shape. Each of the terminals has an attached accommodation block; a two-storey structure on the south side and a single-storey building on the north. The accommodation blocks are braced steel framed areas and are separated from the main terminal building by concrete shear walls, which provide the terminal's stability.

The rounded terminal buildings are formed by a central steel ring which will be supported on temporary props during the erection process. A series of cranked fabricated box sections or tusks act as the structure's ribs and are connected by CHS vertical members.

Steel erection is due for completion in March, with the project expected to be ready by September this year, when Newport will play host to the most prestigious event in golf, the Ryder Cup. The upgraded station will provide for the expected influx of visitors and hopefully become an icon of the city's ongoing regeneration.

FACT FILE

Newport Station Regeneration

Main client: *Network Rail*

Architect: *Grimshaw*

Main contractor: *Galliford Try*

Structural engineer: *Atkins*

Steelwork contractor: *SH Structures*

Steel tonnage: *400t*

Spoilt for choice

Designers of steel frames to the Eurocodes will have columns to verify and even in simple construction, the nominal bending moments we apply make it necessary to treat them as beam-columns. Eurocode 3 offers more than one way to proceed, Alastair Hughes of the SCI compares their merits.

Introduction

We ask a lot from our Codes, perhaps nowhere more than in the realm of column design. We prefer verification member by member, even if it is the frame rather than one individual member which is at risk of instability. Paradoxically, the beam initially responsible for the design moment (and the direction into which the column is encouraged to buckle) can ultimately find itself restraining the column, with a moment in the opposite sense to that designed against. Moreover, real frames do not fail purely through buckling but by a complicated interaction between strength loss and instability. The onset of yielding at a flange tip, much influenced by residual stresses, affects (and is affected by) bending in either direction. So the comments which follow need to be tempered by an awareness of the enormity of the task faced by those who preside over the oracle from which we would wish to receive pronouncements that are clear, easy to follow and simple to apply.

Clause 6.3 of EN1993-1-1

Eurocode 3, influenced no doubt by perceived user demands, adopts a two stage approach. First, methods are given to determine the buckling resistance of a column (with no bending) in 6.3.1 and a beam (with no compression) in 6.3.2. Sometimes this will provide a solution for the task in hand. But if there is a combination of axial compression and bending (the beam-column), or even just biaxial bending (of a less than fully restrained beam), it becomes necessary to do business with 6.3.3. The Clause heading 'Uniform members in bending **and** axial compression' is misleading, because it applies with or without axial compression.

Tower Garage has been a landmark on the road to Ascot since 1935, when it opened as a Vauxhall showroom. Nowadays it is a dealership for Maserati and Ferrari. Photo: Martyn Davies, www.geograph.org.uk/photo/155649

A note explains that the 6.3.3 formulae are 'based on the modelling of simply supported single span members with end fork conditions'. In other words we are simplifying the problem to single members in isolation from their frames. ['End fork conditions' is unfamiliar terminology, but just means the flanges are free to rotate in their own plane – torsional restraint but no warping restraint, to put it another way.] As 6.3.3(3) points out, P-Δ effects for the frame the member is extracted from must be taken into account, either by end moments or by buckling lengths. 6.3.3(2) reminds us that cross-section resistance must always be checked.

As well as being uniform, the cross-section is supposed to be doubly symmetric, though this restriction is relaxed by the UK National Annex (UKNA) – which should be applied for all projects to be constructed in the UK. The expressions are needed for beams (including ASB) as well as columns.

Expressions (6.61) and (6.62)

The expressions can be made more presentable if Class 4 sections are excluded and γ_{M1} is set at 1, the recommended value adopted by the UKNA for buildings (but not for bridges):

$$N_{Ed}/N_{by,Rd} + k_{yy}M_{y,Ed}/M_{by,Rd} + k_{yz}M_{z,Ed}/M_{z,Rd} \leq 1 \qquad \text{(6.61, simplified)}$$

$$N_{Ed}/N_{bz,Rd} + k_{zy}M_{y,Ed}/M_{by,Rd} + k_{zx}M_{z,Ed}/M_{z,Rd} \leq 1 \qquad \text{(6.62, simplified)}$$

The subscript $_{Ed}$ signifies the design force or moment, the maximum anywhere along the member, and subscript $_{by,Rd}$ signifies the design buckling resistance. [In the case of M_z, just plain $_{z,Rd}$ since weak direction bending resistance is not limited by lateral-torsional buckling. For the same reason, the 'y' in $M_{by,Rd}$ is often omitted.] $N_{by,Rd}$ is the resistance of a strut artificially constrained to buckle about the y-axis; it will usually be higher than $N_{bz,Rd}$ (but could be lower, if the weak direction has intermediate restraint). The resistances have been calculated as if the entire cross-section were at the disposal of the effect (*N* or *M*) in question.

These expressions, both of which have to be satisfied, are of the standard Eurocode interaction format, and bear some resemblance to the corresponding expressions of BS5950. Clearly the first relates to buckling in the strong direction and the second to buckling in the weak direction. Since the *M/M* ratios are the same in both, it is the *k*-factors which make the difference to the second and third terms. These *k*-factors are not reduction factors. They can be greater than 1, as well as less.

The choice

What becomes apparent in 6.3.3(5) is that there is a choice between two sets of *k*-factors. That is understatement. There is a choice between two profoundly different methods, because the

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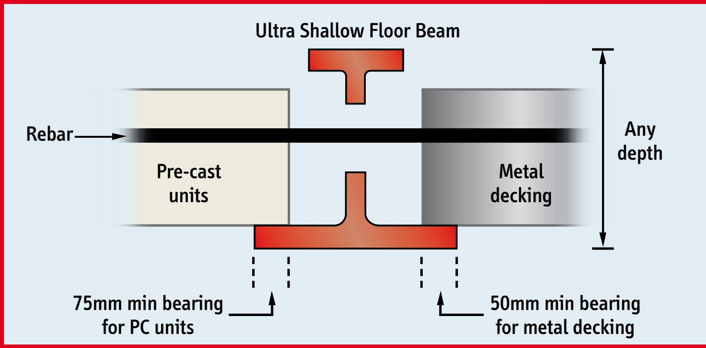

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Code committee could not or would not decide in favour of one over the other.

Code users are not unfamiliar with a choice of verification methods, but nearly always this has been a choice between a simpler, more conservative, method and a more precise or more comprehensive, but more involved, alternative. That is not the situation here; both are put forward as equals, with no suggestion of any circumstances in which their merits or appropriateness might diverge. Nor is it a case of an entrenched traditional method versus an 'advanced' one; both are products of recent research.

A motor industry analogy

It is as if an imaginary totalitarian regime has forced its two car makers, who have different design cultures and speak different languages, to adopt an identical body style. The Model A1 and the Model B2 look the same from the outside, and both promise to convey you to your destination. Lift the bonnet, however, and the machinery is completely, confusingly, different. Both these mechanically sophisticated machines have been developed over the past 15 years to supersede 1993's ENV (the 'draft' Eurocode 3) model, which has been discarded like an old Trabant. Both result from cross-border collaboration; the Model A1 is Belgo-French and the B2 is Austro-German. However the regime is less omnipotent than it might wish. Fundamental differences have proved irreconcilable with the result that both products have been brought to market, with identical styling imposed rather as a fig leaf.

In years to come, when both models will have been fully road tested, a clear 'best buy' may emerge. For now, we can wander round the showroom clutching the brochure (one brochure covers both models) and trying to establish which will serve us best. This article aims to present an interim consumer report.

Annexes A and B of EN1993-1-1

These annexes contain the k-factors for 'Method 1' and 'Method 2' respectively, so they encapsulate the differences. Both have 'informative' status, which means that a National Annex (NA) is empowered to declare them invalid, but if it does not do so both are equally valid. Indeed there is officially nothing to prevent two adjacent columns in the same building being verified by different Methods. But anyone hoping to survive on the European highway without divine (or electronic) assistance would be well advised to familiarize with one or other of the two vehicles. Their controls are quite differently arranged - different sign conventions, different equivalent uniform moment factors. Accidents waiting to happen?

Both the annexes are presented in tabular form, as a sea of algebra. Both are more complicated than anything in BS5950 and, to the average driver, emphatically not user-serviceable. The UKNA licenses the use of both models

The Brochure (ECCS 119)

ECCS Publication 119 provides impressive product support, but may not be what you expected to find in the glovebox

Perhaps 'brochure' is the wrong word, because the salesmanship is distinctly low key. It is more of a manual, but an explanatory manual rather than a service manual. In Eurocode terms it is 'background documentation', to record the reasons for the Code being written as it is. It would also class itself as non-conflicting complementary information (NCCI), incorporating as it does some 'textbook' material excluded by Code rules. It is a self-justificatory piece of work, and in many respects a good one. However its theoretical sections are pitched at a level which will make the average driver feel rather weak; even the elite specialists may not all make it through to the supplementary material on the disc in a pocket at the back.

It should be noted that the publisher is not the Code committee but the European Convention for Constructional Steelwork (ECCS) Technical Committee 8 under whose auspices both methods were prepared, by analogy the Society of Motor Manufacturers.

Designers who departed the academic world more than a few years ago may be interested in the way they set about making a Code these days. Comparatively little laboratory or field testing is involved (often only sufficient testing to allow calibration and validation of models). Instead, powerful elastic-plastic finite element analyses, taking account of residual stresses, geometrical imperfections and strain hardening, are used to simulate the performance of a wide range of member sizes, shapes and conditions. These virtual tests are much cheaper than real ones (allowing a much greater number of cases to be investigated), and some would even claim that they are more believable, though the assumptions made (about residual stresses for example) have to be validated by real tests. Having assembled a set of tests sufficient to represent the full range of practical situations, Code rules are formulated to safely bound the results.

Both models have been developed in this way. One fundamental difference between them is that the A1 takes a sinusoidal bending moment diagram as its starting point whereas the B2 is based on uniform bending moment diagram. No wonder the equivalent uniform moment factors are different. The A1 maintains separate factors for material and geometrical nonlinearities, which are 'globalized' in the B2. Other variations are that one has N/Ncr as an influence, the other purely the shape of the bending moment diagram, and that one is based on maximum moment and associated displacement, whereas the other is based on the ratio of moments in opposite senses. Better not say 'of opposite sign', because the sign conventions are completely opposed!

ECCS 119 presents a number of worked examples using both methods in turn. It is reassuring that the results are usually close. There is some suggestion by the authors that A1 is more precise and productive than B2. The asserted precision cannot readily be confirmed or denied, but rather contrarily it turns out that B2 gives higher resistance in at least half of the examples.

What choice is the practical designer to make?

A sensible choice might be to invest in some software. It's what the manual advises us to do, in retaliation against the anticipated accusation of overcomplexity. So, to rephrase the question, what choice is the software provider to make? One answer is both, as for verification either will suffice. It can be foreseen that there will be close calls where only one will make it across the line, but it cannot be foreseen which one that will be. Software incorporating both, together with a central log of the results, could give us all a much better idea of which is the more productive.

Let us not evade the question any further. To force a choice, here is a summary of the evidence assembled so far.

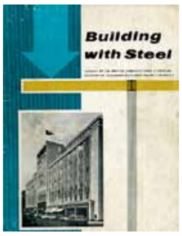
In favour of Model A1:

- Its originators assert that it is more precise and productive
- Buckling mode factors in the literature can be used with it

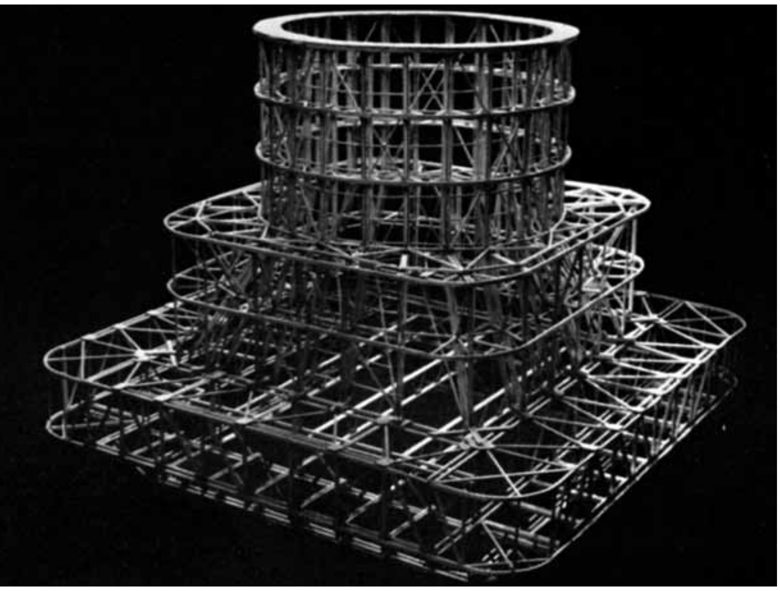
In favour of Model B2:

- It is marginally simpler, and perhaps less obscure
- It can cope with different patterns of restraint in the two directions – a very real possibility in a portal frame, for example
- It is compatible with EN1993-6 Annex A (used where torsion combines with bending)
- The UKNA allows its use for non-doubly symmetric sections such as ASB

For most of us at the SCI this adds up to a convincing, but not compelling, case for B2. We hesitate to make a firm 'best buy' recommendation lest this becomes self-fulfilling, but it does seem to have most to offer. Others agree; Mike Banfi's simplification proposal (The Structural Engineer, Vol 86 #21 Nov 2008) is based on it, and is expected to be included in IStructE's forthcoming Manual.



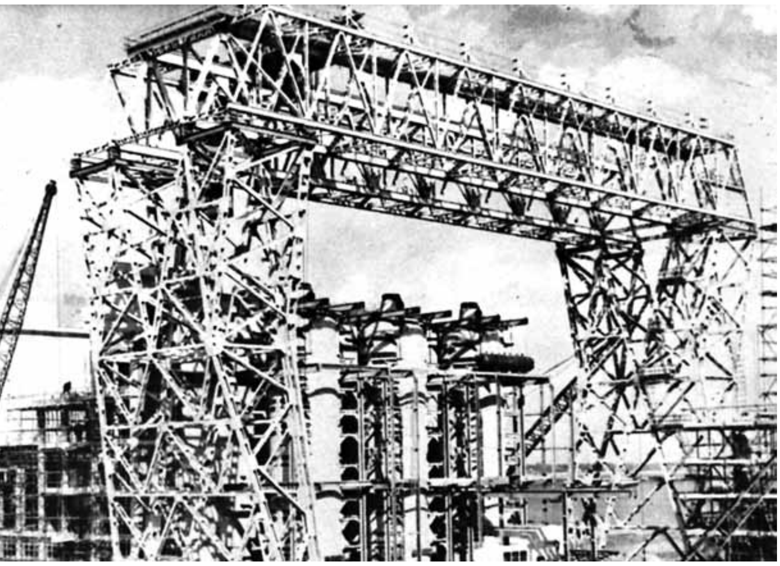
Structural Steel in the Nuclear Power Industry



Above: Filter assembly for Windscale Chimneys.

Left: Large though it is, Dounreay's containment sphere is dwarfed by the giant crane used during its construction.

Below: Structural steelwork being erected round Bradwell's insulated boilers, here framed by the 187 ft span of the Goliath crane.



Structural steel is marching with the times. Nuclear power stations – virtually unthought of a decade ago – are consuming large quantities of structural steelwork in both new and traditional applications. Windscale, Britain's first large venture into the atomic energy field, used 17,000 tons; the atomic factory at Capenhurst used an initial order of 20,000 tons and then called for more in order to extend; at Dounreay, more that 5,000 tons were used. The 'true' power stations now being built are using even more, and for purposes varying from conventional girder structures to mammoth cranes as tall as Nelson's Column.

THE EARLY DAYS...

Like so many things invented by man, the first nuclear reactors were built for warlike purposes. The USA employed the first ones to produce military plutonium, and Britain's first atomic plant – at Windscale – was built for the same reason.

Calder Hall saw the beginning of the nuclear electricity era: the electricity here being a secondary product of the plutonium plant. That was just over three years ago. Today a new power station at Chapelcross, the first to be built primarily as a power station, is in operation. Others, in differing stages of construction, are going up at Bradwell, Berkeley, Hinkley Point, Hunterston and Trawsfynydd. Britain is now well on the way to achieving the generating capacity called for in the 1955 White Paper: twelve stations generating between 1,500,000 and 2,000,000 kW by 1965.

WINDSCALE AND DOUNREAY...

Seventeen thousand tons of structural steelwork: that was the first indication industry received of the quantities likely to be required by the programme and was the amount employed in the buildings and other structures at Windscale. Although Windscale produces plutonium and not electricity, it is important in that it was the first large-scale unit built in Britain's military programme in this field. The buildings are conspicuously different from those at a civil nuclear power station, the site being dominated by two giant chimneys each 414 ft. tall. On top of each of these is a 200-ton steel filter assembly – rather like storks nests.

Dounreay is capable of contributing 15,000 kW to the National Grid. It was built primarily as a fast breeder research station and, like Windscale, differs considerably from conventional power stations in appearance. Here, everything on site is dwarfed by the containment sphere. Five thousand tons of structural steelwork were used at Dounreay, much of it in connection with this sphere. The steelwork was used principally in the form of lattice-type straight and radial girders, floors, columns and crane girders. The seven-floor active element store building – 86ft high by 55ft by 66ft – is of beam and stanchion construction; it has seven floors, some of which are chequer plated.

To the west of the sphere is the heat exchange building, also of beam and stanchion construction. This has five floors, four of which are chequer plated, with castellated beams at one of the floor levels.

THE GOLIATH CRANE...

Besides being used extensively in the permanent structures at power stations, structural steelwork is also called upon to fulfil equally vital but temporary roles. For instance, a great deal of heavy lifting work has to be done to instal reactor and other vessels. Conventional cranes cannot cope with the loads and heights involved and special forms of lifting gear have been devised to carry out this work. Typical of these is the Goliath crane used at Bradwell-on-Sea, Essex. This is of the overhead girder type, and is supported at each end by a leg mounted on eight four-wheel bogies. The crane straddles the reactor building during all stages of construction and is designed to lift 200 tons to a height of 140ft; an auxiliary hoist can lift 30 tons.

THORP Receipt and Storage Facility, Sellafield

For: British Nuclear Fuels plc

Architects:
BNF plc – Building & Civils Design Office

Structural Engineers:
Allot & Lomax

Steelwork Contractor:
Octavius Atkinson & Sons Limited
William Hare Limited

Main Contractor:
Sir Robert McAlpine & Sons Limited

The Thermal Oxide Reprocessing Plant (THORP) at Sellafield in Cumbria is one of the major civil engineering enterprises of the century. The Receipt and Storage facility forms the first part of this project and required in both design and construction the uniquely rigorous standards which exemplify the attention given to safety in the UK nuclear industry..

THORP has been constructed to the highest modern quality and safety standards, which include resistance to such environmental conditions as earthquakes and extremes of wind and temperature. Consideration has been given to the effects of possible impact loads arising from the handling of flasks weighing up to 150 tonnes.

The facility will receive shielded flasks containing spent nuclear fuel from a rail head. The fuel is stored below water prior to chemical reprocessing. The principal parts of the facility are the Receipt Building, which is a multi-storey steel framed structure, the Inlet Pond which is a stainless steel lined reinforced concrete structure, and the Storage Pond which is constructed in water-retaining concrete within a steel framed Pond Hall.

The 35m high frame of the Receipt Building has been designed to sustain the lateral forces associated with severe seismic action. This condition required elastic analysis treating the base and eaves joint of the frame as fixed. Economy of material has been achieved by developing the full plastic strength of sections at points of maximum stress and by mobilising the inherent ductility of the steel using appropriate detailing to absorb some of the earthquake energy. Longitudinal stability against wind and seismic action is ensured by the provision of a double line of diagonal bracing.

The main transverse frames were fabricated as welded plate sections and all internal steel was fabricated out of hot rolled sections. One unique feature of the design is the provision of a roof spanning 40m over the Storage Pond formed entirely in stainless steel. The deck consists of rolled stainless steel units and the truss is made up of angles pressed out of stainless steel plate. All steel grades were selected to ensure that brittle fracture is prevented at extreme low environmental temperatures. The project incorporates about 4200t of carbon steel and 600t of stainless steel.

The outer cladding consists of ‘Perfrisa’ panels. The cladding and its supports were designed to withstand the wind forces associated with a 1 in 10,000 year storm and as part of the design development for the cladding and its immediate fixings, an extensive test programme was undertaken.

The entire design and construction of the facility has been set against the background of a former statutory safety case requiring the implementation of comprehensive Quality Assurance for all aspects of the work. The facility was commissioned to budget and programme and received its first fuel in July 1998.

Judges’ Comments:

The design and construction team devised simple and well-proportioned solutions to satisfy the rigorous and complex criteria. They have achieved a well integrated and high quality heavy engineering structure.

New and Revised Codes & Standards

(from BSI Updates February 2010)

BS EN PUBLICATIONS

BS EN ISO 3506-1:2009
Mechanical properties of corrosion-resistant stainless steel fasteners. Bolts, screws and studs
Supersedes BS EN ISO 3506-1:1998

BS EN ISO 17638:2009
Non-destructive testing of welds. Magnetic particle testing
Supersedes BS EN I290:1998

BS EN ISO 23277:2009
Non-destructive testing of welds. Penetrant testing of welds. Acceptance levels
Supersedes BS EN 1289:1998

BS EN ISO 23278:2009
Non-destructive testing of welds. Magnetic particle testing of welds. Acceptance levels
Supersedes BS EN 1291:1998

CORRIGENDA TO BRITISH STANDARDS

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

ISO PUBLICATIONS

ISO 14713-1:2009
Zinc coatings. Guidelines and recommendations for the protection against corrosion of iron and steel in structures. General principles of design and corrosion resistance
Will be implemented as an identical British Standard

ISO 14713-2:2009
Zinc coatings. Guidelines and recommendations for the protection against corrosion of iron and steel in structures. Hot dip galvanising
Will be implemented as an identical British Standard

ISO 14713-3:2009
Zinc coatings. Guidelines and recommendations for the protection against corrosion of iron and steel in structures. Sherardizing
Will be implemented as an identical British Standard

Advisory Desk

AD 343
Position of reinforcing mesh relative to stud shear connectors in composite slabs

The purpose of this Advisory Desk note is to clarify the requirements for the position of mesh reinforcement relative to stud shear connectors in composite slabs. Traditionally, advice was that it was necessary to position mesh reinforcement below the head of the stud shear connectors to ensure that the design shear resistance of the connectors could be realized[1]. However, the mesh reinforcement was often used to limit cracking and also used to provide bending continuity over beams for composite slabs in the fire condition, which required the mesh to be high in the slab to be efficient for these purposes.

BS EN 1994-1-1 clause 6.6.5.1 and Figure 6.14 require the "bottom reinforcement" to lie at least 30 mm below the head of the stud. It has been suggested that this rule is applicable to composite slabs as well as to solid slabs. However, SCI's view is that this clause should only be applied to solid slabs (without decking), given the reference to bottom reinforcement. It may be seen that Figure 6.14 shows a solid slab with two layers of reinforcement. In the UK, in conventional composite slabs, there is normally only one layer of reinforcement, making the application of the clause to composite slabs inappropriate.

Recent push-out tests on composite slabs with a single layer of mesh above the heads of the studs investigated the strength and ductility of the shear connection in this situation. Based on that research, two recently published NCCI documents, PN001 and PN002 (see *www.steel-ncci.org*) give advice on shear resistance and minimum degree of shear connection for composite slabs when designing to BS EN 1994-1-1. The NCCI documents state that for single studs there is no reduction in the stud resistance when the mesh is above the stud, but for pairs of studs the resistance is reduced, and reduction factors are given in PN001.

It is therefore considered satisfactory (and better from a buildability point of view) to place the mesh above the studs and use it for both longitudinal shear resistance, and for integrity in the fire design situation, provided that when assessing the shear connection the appropriate reduction factor in PN001 is applied to the value of stud resistance given by BS EN 1994-1-1.

The situation regarding design to BS 5950-3.1 is simpler. Although the revised rules in the amendment to BS 5950-3.1 (to be published in March 2010) show lower values of the reduction factor k in 5.4.7.2 than previously, for both single and pairs of studs, there is no restriction on the position of the mesh. Therefore, the stud resistances calculated to BS 5950-3.1, as modified by the new amendment, are valid for mesh positions up to that for minimum cover (i.e. near the top of the slab).

Contact: J W Rackham
Tel: 01344 636525
Email: advisory@steel-sci.com

References

(1) *RACKHAM, J.W, COUCHMAN, G.H and HICKS, S.J Composite Slabs and Beams Using Steel Decking: Best Practice for Design and Construction, 2nd edition (P300), The Steel Construction Institute and MCRMA, 2009.*

Steelwork contractors for buildings

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

Gillian Mitchell MBE, Deputy Directory General, BCSA, 4 Whitehall Court, London SW1A 2ES
Tel: 020 7839 8566 Email: gillian.mitchell@steelconstruction.org

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

- **C** Heavy industrial platework for plant structures, bunkers, hoppers, silos etc
- **D** High rise buildings (offices etc over 15 storeys)
- **E** Large span portals (over 30m)
- **F** Medium/small span portals (up to 30m) and low rise buildings (up to 4 storeys)
- **G** Medium rise buildings (from 5 to 15 storeys)
- **H** Large span trusswork (over 20m)
- **J** Tubular steelwork where tubular construction forms a major part of the structure
- **K** Towers and masts
- **L** Architectural steelwork for staircases, balconies, canopies etc
- **M** Frames for machinery, supports for plant and conveyors
- **N** Large grandstands and stadia (over 5000 persons)
- **Q** Specialist fabrication services (eg bending, cellular/castellated beams, plate girders)
- **R** Refurbishment
- **S** Lighter fabrications including fire escapes, ladders and catwalks
- **QM** Quality management certification to ISO 9001

Notes

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

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

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

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

Associate Members

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

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

Company name	Tel	1	2	3	4	5	6	7	8	9
AceCad Software Ltd	01332 545800		●							
Advanced Steel Services Ltd	01772 259822								●	
Albion Sections Ltd	0121 553 1877	●								
Andrews Fasteners Ltd	0113 246 9992									●
ArcelorMittal Distribution – Bristol	01454 311442								●	
ArcelorMittal Distribution – Mid Glamorgan	01443 812181								●	
ArcelorMittal Distribution – Birkenhead	0151 647 4221								●	
ArcelorMittal Distribution – Scunthorpe	01724 810810								●	
Arro-Cad Ltd	01283 558206			●						
ASD metal services - Biddulph	01782 515152								●	
ASD metal services – Bodmin	01208 77066								●	
ASD metal services - Cardiff	029 2046 0622								●	
ASD metal services - Carlisle	01228 674766								●	
ASD metal services - Daventry	01327 876021								●	
ASD metal services - Durham	0191 492 2322								●	
ASD metal services - Edinburgh	0131 459 3200								●	
ASD metal services - Exeter	01395 233366								●	
ASD metal services - Grimsby	01472 353851								●	
ASD metal services - Hull	01482 633360								●	
ASD metal services – London	020 7476 0444								●	
ASD metal services - Norfolk	01553 761431								●	
ASD metal services - Stalbridge	01963 362646								●	
ASD metal services - Tividale	0121 520 1231								●	
Austin Trumanns Steel Ltd	0161 866 0266								●	
Ayrshire Metal Products (Daventry) Ltd	01327 300990	●								
BAPP Group Ltd	01226 383824									●
Barnshaw Plate Bending Centre Ltd	0161 320 9696	●								
Barrett Steel Services Ltd	01274 682281								●	
Bentley Systems (UK) Ltd	0141 353 5168		●							
Cellbeam Ltd	01937 840600	●								
Cellshield Ltd	01937 840600							●		
CMC (UK) Ltd	029 2089 5260							●		
Composite Metal Flooring Ltd	01495 761080	●								
Composite Profiles UK Ltd	01202 659237	●								
Computer Services Consultants (UK) Ltd	0113 239 3000		●							
Cooper & Turner Ltd	0114 256 0057									●
Corus	01724 404040				●					
Corus Ireland Service Centre	028 9266 0747								●	
Corus Panels & Profiles	01684 856600	●								
Corus Service Centre Dublin	00 353 1 405 0300								●	
Corus Tubes	01536 402121				●					
Corus Wednesfield	01902 484100								●	
Daver Steels Ltd	0114 261 1999	●								
Development Design Detailing Services Ltd	01204 396606			●						
Company name	**Tel**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**

Company name	Tel	1	2	3	4	5	6	7	8	9
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	●								
Hilti (GB) Ltd	0800 886100									●
International Paint Ltd	0191 469 6111						●			
Interpipe UK Ltd	0845 226 7007								●	
Jack Tighe Ltd	01302 880360						●			
Kaltenbach Ltd	01234 213201					●				
Kingspan Structural Products	01944 712000	●								
LaserTUBE Cutting	0121 601 5000								●	
Leighs Paints	01204 521771						●			
Lindapter International	01274 521444									●
Metsec plc	0121 601 6000	●								
MSW Structural Floor Systems	0115 946 2316	●								
National Tube Stockholders Ltd	01845 577440								●	
Northern Steel Decking Ltd	01909 550054	●								
Northern Steel Decking Scotland Ltd	01505 328830	●								
John Parker & Sons Ltd	01227 783200								●	●
Peddinghaus Corporation UK Ltd	01952 200377					●				
Peddinghaus Corporation UK Ltd	00 353 87 2577 884					●				
PMR Fixers	01335 347629	●								
PP Protube Ltd	01744 818992	●								
PPG Performance Coatings UK Ltd	01773 837300						●			
Prodeck-Fixing Ltd	01278 780586	●								
Profast (Group) Ltd	00 353 1 456 6666									●
Rainham Steel Co Ltd	01708 522311								●	
Richard Lees Steel Decking Ltd	01335 300999	●								
Rösler UK	0151 482 0444					●				
Schöck Ltd	0845 241 3390	●								
Site Coat Services Ltd	01476 577473						●			
Steel Projects UK Ltd	0113 253 2171		●							
Steelstock (Burton-on-Trent) Ltd	01283 226161								●	
Structural Metal Decks Ltd	01202 718898	●								
Structural Sections Ltd	0121 555 1342	●								
Studwelders Ltd	01291 626048	●								
Tekla (UK) Ltd	0113 307 1200		●							
Tension Control Bolts Ltd	01948 667700									●
Voortman UK Ltd	01827 63300					●				
Wedge Group Galvanizing Ltd	01909 486384						●			
Company name	**Tel**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**

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

* Denotes membership of the BCSA

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, plus information on steel design, erection, specification, health & safety, quality, sustainability, publications and much more.

The British Constructional Steelwork Association Ltd and
The Register of Qualified Steelwork Contractors for Bridgeworks

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