SEPTEMBER 2008 VOL 16 NO 8

NSC

NEW STEEL CONSTRUCTION

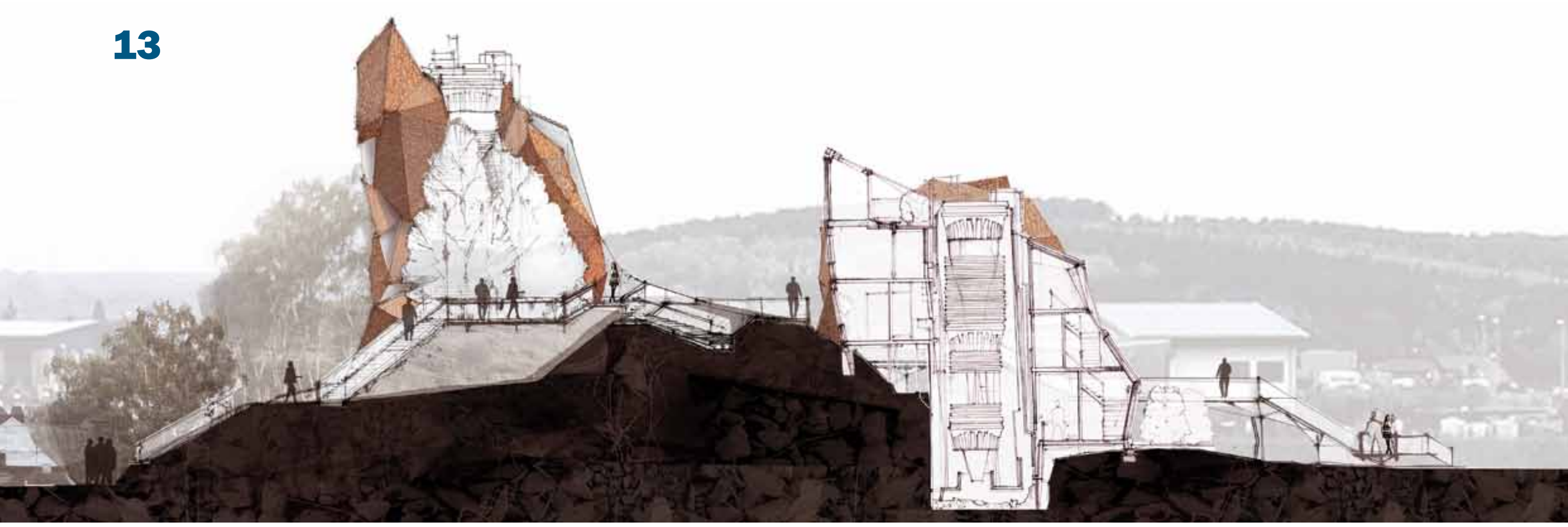
www.new-steel-construction.com

Salford's Media City
Regenerating Walsall
Crane tops Mayfair core
New O_2 in Dublin

SEPTEMBER 2008 VOL16 NO8

CONTENTS

13



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

5 **Editor's comment** Nick Barrett looks forward to work on the 2012 Olympic Games construction programme being given a boost by the UK's medal success in Beijing.

6 **News** Construction work at London's 2012 Olympic site is progressing ahead of schedule in readiness for the forthcoming steelwork erection.

12 The winners of the annual **Corus Student Awards**, divided into a structures and a bridges category, were praised for their creativity.

13 A competition brief, entitled 'Living with waste' brought the best out of entrants for the **Corus Student Awards for Architecture**.

14 As part of a £14M redevelopment, the new **Lambeth College Clapham Centre** will feature an eye-catching steel roof structure.

16 A steel framed studio building with two conjoined towers,16-storeys and 19-storeys high respectively, is the centrepiece of the **Media City** project in Salford.

20 The market town of **Witney** is getting a makeover with a new retail and leisure development.

22 The new Business and Learning Campus for **Walsall College** forms an integral part of the £750M redevelopment of the West Midlands town.

26 The second article in the **Steel Supply Chain** series describes the role of light gauge and floor decking manufacturers.

28 An innovative use of Corus Bi-Steel panels and Corefast system has speeded up construction on a prestigious central London project.

30 The Irish capital's premier music venue is being rebuilt within three historic retained facades and will be known as the O_2 Dublin.

34 With implementation of the Eurocodes imminent, this month's technical article explains the differences between the new standards and previous guidance.

38 **Codes and Standards.**

40 **40 Years Ago** Our look back through the pages of Building with Steel features the John Hancock Centre in Chicago.

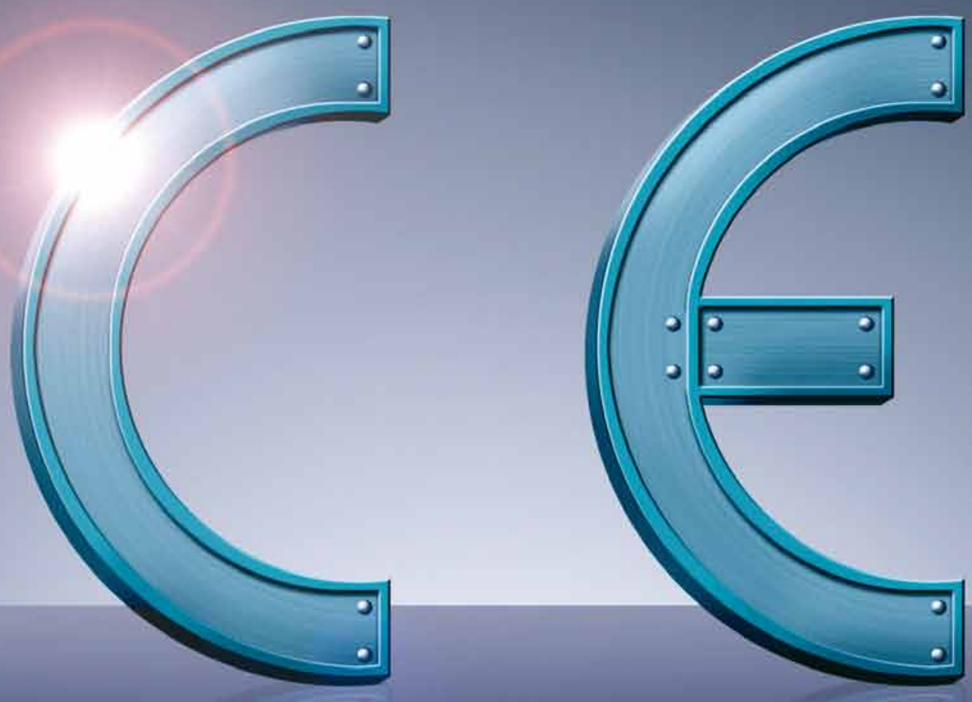
42 **Advisory Desk** The latest advice from the SCI - AD325 - curtailment of transverse bar reinforcement in composite beams with steel decking and - AD326 - revision of BS 5400-3 LTB rules.

44 **BCSA members**

46 **Register of Qualified Steelwork Contractors**

47 **SCI members**

Cover Image
New Walsall College Business and Learning Campus, West Midlands
Client: Walsall First
Architect: Dyer Associates
Steelwork contractor: Conder Structures
Steel tonnage: 1,400t



Making a **mark** in steel construction

CE Marking Conference 28th October 2008 at The Institute of Directors, 116 Pall Mall, London SW1

The new standard for the CE Marking of structural steelwork recently was accepted by the Member States of the European Union and comes into force on 1st January 2009 - it will become 'mandatory' for all steel structures designed and constructed throughout the UK and Europe in April 2010. The aim of Conference is to explain the implications for specifiers, designers and contractors.

The Conference and the new Guide will cover:

- The CE Marking Regulations
- The new steelwork fabrication standard (EN 1090-2)
- The changes to the Construction Products Directive
- Execution Classes: implications for designers
- Responsible Welding Co-ordinator
- Welding Quality Management
- Factory Production Control and Traceability
- Routes to Certification and Legal Enforcement

The Conference will be Chaired by Richard Barrett, BCSA President, and the Keynote address will be given by a representative from the Department for Communities and Local Government.

The Speakers will include:

Dr David Moore CEng BTech PhD MIStructE
Dr Roger Pope MA MSc DPhil CEng FIMechE FIStructE MCIArb
Jeff Garner MSc CEng MWeldI EWE
Jim Carmichael MIQA EngTech TechWeldI Registered Lead Auditor

The Conference fee is £100, plus VAT = £117.50 (25% discount for BCSA members), which includes lunch and a copy of the new BCSA publication 'Steel Construction Guide to CE Marking'

Please reserve [ ] place(s) at the CE Marking Conference on Tuesday 28th October 2008 at the Institute of Directors, 116 Pall Mall, London SW1Y 5ED.

I enclose cheque value £ [ ] made payable to BCSA.

A VAT receipted invoice will be issued upon receipt of payment.

Please debit my VISA / AMEX / Mastercard* card (*delete as applicable)

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Please register the following people for the conference:

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Please return to: Gillian Mitchell, BCSA, Suite 15, 1st Floor, Unit 5, Carrwood Park, Selby Road, Leeds LS15 4LG. VAT No 606 1969 33

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The British Constructional Steelwork Association Ltd
SCI

A lasting legacy

Britain's long-standing love affair with the modern Olympics has been given a timely boost by the outstanding performance of our athletes at the Beijing games. Since the first flurry of excitement generated in 2005 by London winning the staging of the 2012 Olympics and Paralympics, the headlines have been mostly about scaling back the original ambitions for building the stadiums and other structures needed to host such a large event. Our news story this month details progress on the sizeable projects that make up the 2012 Olympic project.

UK success on the scale that we have seen at Beijing should hearten everyone involved in the often difficult process of ensuring that London is ready for 2012, including the construction teams who are now gearing up for a major push to get the venues built. The various elements are all falling into place to make London 2012 a games to be proud of.

The Olympics building programme, in the hands of the Olympic Delivery Authority (ODA), has looked like a tough event to be in at times. Construction cost inflation has been high since 2005 and the organisers have been forced to work within tighter budgets than they would perhaps have liked. But the designs that are making it off the drawing board are impressive and represent the biggest sports related construction programme that the UK has ever seen; and will still provide a major platform for steel construction to show what it can do.

The ODA has five priority themes to guide its construction work: health and safety, sustainability, design and accessibility, equality and inclusion, and legacy. The smart money says that selecting steel will prove to have been the best way of meeting these objectives.

Construction has started on the main Olympic Stadium, an 80,000-seat venue that will be scaled back to 25,000 seats after the games thanks to the demountability of steel, ensuring that the legacy is not an underused white elephant. It is not clear yet what bodies will have legacy use of the stadium, but whoever it is will have an attractive, adaptable, flexible stadium in which to show off their sporting prowess. The same is true for the other Olympic structures.

The ODA website acknowledges the contribution that steel will make to the sustainability credentials of the 2012 Olympics, saying that the stadium is highly sustainable as the 10,000t of steel that will be used in it means it will be the lightest Olympic stadium ever. The entire steel construction sector can take pride in the contribution that they are making towards the London Olympics in 2012 being the most sustainable games to date.

Nick Barrett - Editor

Construction surges ahead on Olympic Stadium

The construction of the Olympic Stadium in east London is surging ahead with piling work to create the permanent foundation expected to be completed this month.

Olympic Delivery Authority Chief Executive David Higgins, said: "The stadium site is now a hive of activity and over the coming months we will see the structure start to rise from the ground."

More than 800,000t of soil has been taken away to help create the construction platform for the stadium, an amount that would fill the Royal Albert Hall nine times.

Tower cranes are now in position within the stadium bowl and steel erection is scheduled to begin over the coming months. The highly sustainable structure will require 10,000t of structural steel making it the lightest Olympic stadium to date.

Sir Robert McAlpine has the main stadium contract, while across the Olympic site Balfour Beatty has the aquatics centre deal. Piling work began during July on the aquatics centre site and groundworks are also under way at the Olympic Village project, a contract being undertaken by Bovis Lend Lease.

Piling is nearing completion on the Olympic Stadium site in readiness for steel erection.

Office development nearing its pinnacle

Offering more than 23,000m^2 of office space, the Pinnacle will on completion be one of the largest commercial schemes in Milton Keynes.

The development comprises three blocks; two connected and one detached ranging from five storeys to eight storeys in height.

The project is a joint venture between Marriott Construction and Kier Build for developer Hampton Brook. Steelwork contractor Billington Structures has recently completed the erection of some 1,200t of structural steel.

The entire project is due to be completed by early 2009.

Major works progressing at Heathrow Airport

Refurbishment work at Heathrow Terminal 4 is currently on going with a new and improved check-in hall and airside lounge being constructed. The extended check-in hall will double the existing space and will feature a large column-free area topped with a transparent ETFE canopy.

Improvements to the existing short stay car park are also being undertaken. This structure will carry additional loading from a new public transport drop-off point, and the works include using steel plates to give the building extra strength.

Watson Steel Structures has recently started steel erection on site, working on behalf of construction manager Taylor Woodrow. Structural engineer for the project is Buro Happold.

On a separate contract, Bourne Off-Site Solutions has recently completed some complex night time steel erection for the pre-enabling works for the new Heathrow East Terminal.

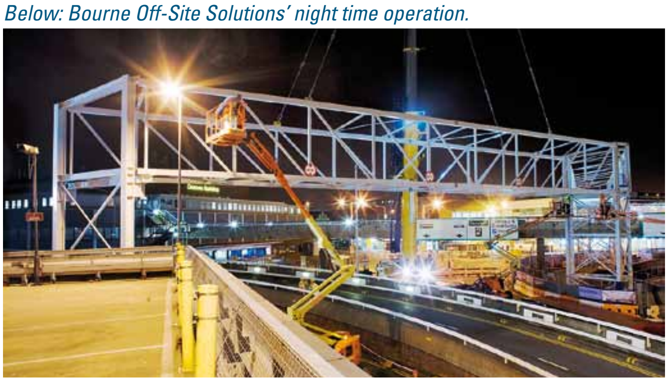
Eventually replacing Terminal Two, the new building will require some major service lines prior to the main construction work beginning. Much of this preliminary work has involved Bourne erecting service towers and bridges which will carry utilities over the surrounding busy roads.

Bourne Off-Site's Project Manager John Hanson, said: "Heathrow is extremely busy and we only had a four hour night time working window for the lifting and erection work."

The largest installation involved Bourne erecting a 34m-long pre-assembled bridge between two steel towers. The bridge was lifted into place in two pieces, each weighing 15t and measuring 34m in length.

The operation was completed in one night and allowed pre-assembled steel service modules to be lifted into place over the following nights.

Above: Impression of Terminal 4's revamped check-in hall.
Below: Bourne Off-Site Solutions' night time operation.



BCSA outlines CE Marking options for stockholders

After two recent BCSA Process and Technical Committee meetings two options regarding stockholders' compliance with forthcoming CE Marking legislation were put forward.

Services offered by stockholders include a number of fabrication activities, such as drilling, cutting and painting, which are covered by the new CE Marking standard BS EN 1090-1.

The two options discussed are: Option 1, whereby the stockholder is sub-contracted to the steelwork contractor and all of its activities are encompassed by that steelwork contractor's CE Marking processes. Option 2, would see stockholders CE Marking modified sections in accordance with BS EN 1090-1.

Dr David Moore, BCSA Director of Engineering, said: "At both meetings the preferred option was for stockholders to implement Option 2 and CE Mark the modified steel sections in accordance with the forthcoming European standard."

BS EN 1090-1 has recently been approved by Member States and it is anticipated that it will come in to force in October this year. Currently there is a one year overlap when either national provisions or the CE Marking standard may be used.

For further information on CE Marking, setting up factory production control systems and the certification process, BCSA members should contact: david.moore@steelconstruction.org; jeff.garner@steelconstruction.org or jim.carmichael@steelconstruction.org.

New high performance bandsaws

A new range of Behringer automatic CNC bandsaws has been launched in the UK by Kaltenbach.

The HBV500A and HBV420A are both general purpose, high performance, straight cutting bandsaws with material cutting capacities of 500mm x 500mm flat and 500mm x 420mm flat respectively.

"These new models provide good value performance and cost per cut technology for a general mix of materials from the exotic to regular steels," said Barry Rooney, Kaltenbach Sales and Marketing Manager.

Features included in the new range include a fully enclosed housing design which provides extra safety, sound attenuation and swarf management.

The HBV units have a heavy vibration free cast base and the familiar rigid Behringer ground twin pillar design.

"An enhanced swarf discharge efficiently clears swarf away from the cutting area, which is vitally important with fast cutting rate metals such as aluminium," added Mr Rooney.

Steel schools for Sunderland

Barrett Steel Buildings is working on four Sunderland schools for the Building Schools for the Future (BSF) scheme with main contractor Balfour Beatty.

The company has recently completed erecting 390t of steel on Washington School and a further 313t at Castleview School (left). Pennywell and Hylton Red House schools are due to be completed by the end of September.

Chris Heptonstall, Associate Design Director for Barrett Steel Buildings, says Pennywell is the overall flagship school among the four individual projects.

"We are erecting 452t of steel at this school and the work has been both intricate to design and erect."

Pennywell features a sloping site and six separate three and two-storey buildings which are all linked by covered walkways.

Although all the schools are all located within a three mile radius, Barrett Steel Buildings has individual project teams for each site.

For the benefit of each of the project's construction teams (main contractor, architect and structural engineer) Barrett Steel Buildings is issuing a weekly email update of the steelwork.

"The email contains a link to our system so team members can view up-to-date development of the 3D Tekla steel model," explains Mr Heptonstall. "This interaction is most advantageous when reviewing interfaces with other trades."

AROUND THE PRESS

Building Magazine
11 July 2008
High flying steel
Unilever House in London is the winner of one of four 2008 Structural Steel Design Awards made by the British Constructional Steelwork Association and Corus. The judges were impressed by the circulation areas that float dramatically in a spacious atrium.

Off Site Construction
July/August 2008
Tech talk
Niilo Kokkarinen from Samesor stated that: "the UK is a world leader in multi-storey structural steel use." With manufacturing technology and automation being described as central to the successful delivery of a steel frame project.

Off Site Construction
July/August 2008
Steel & sustainability
Construction methods such as steel frame rather than bricks and mortar will perform better during construction in terms of embodied energy and CO_2 emissions, for example saving 20% CO_2 in domestic housing.

Building Magazine
1 August 2008
Stanhope to test new building method
Stanhope is to pioneer the use of a steel composite building system which it hopes will cut construction time by up to a third. The developer is planning to use the lightweight system, which combines steel with polyurethane, in place of conventional concrete floors.

The Structural Engineer
5 August 2008
Structural Steel Design Awards celebrate 40 years
All of the projects shortlisted for the 2008 SSDA illustrate the way in which constructional steelwork continues to play a vibrant, forward thinking and innovative part in the success of the construction industry. The performance of steel in the UK market continues to be one of the great industrial success stories of recent times.

SCI calls for clearer sustainable housing timetable

Dr Bassam Burgan, Deputy Director of SCI and Chair of the Steel Homes Group, has called on the Government to provide a clearer timescale for the introduction of rules on the sustainability of new housing developments.

The industry needs clarity on how to address the issue of sustainability, said Dr Burgan, in order to address the avoidable impact on the environment by the construction industry.

The Government launched the Code for Sustainable Homes in December 2006, with a sliding scale aimed at encouraging developers to aspire to more environmentally friendly construction. But with no timescale set down for mandatory regulations, there has been limited practical response within the industry.

Dr Burgan said: "I certainly welcomed the Code but more than a year after it was announced I don't feel the industry knows exactly what do to with it. The public sector has had a clear timetable laid down for it, but without a similar plan for the private sector, many people are confused.

"The construction industry is responsible for a substantial amount of environmental pollution, but this doesn't have to be the case. If it made better use of off-site construction techniques, using steel framed homes, then the UK would be getting an improved and sustainable end product."

Blackburn bridge opening heralds regeneration

The £8M Wainwright Bridge in Blackburn recently opened and is set to be a fundamental part of Blackburn-with-Darwen Borough Council's plans for local regeneration.

The bridge is part of the first phase of the proposed Blackburn Orbital Route and provides links to nearby brownfield sites earmarked for redevelopment.

Capita Symonds provided structure design, project management, civil engineering and landscape services on the project, which consists of a single span 78m steel bowstring arch bridge with a steel/concrete composite deck carrying a dual carriageway.

Councillor Alan Cottam, Executive Member for Regeneration, said: "The Wainwright Bridge is a modern full width bridge for all – cyclists, buses and cars. It does not have a height restrictions like Darwen Street bridge and will bring traffic onto the new link road, which also has access to all the car parks. It will also open up a large area of the town centre for commercial development and regeneration."

Civic offices scoop galvanizing award

The new Civic Offices for Cork City Council designed by ABK Architects was named the overall winner of the 2008 and 16th annual Hot Dip Galvanizing Awards.

The building which provides 9,200m^2 of office space, together with 140 car park spaces also picked up the Sustainability award. The judges said crystalline glass and galvanized steel have been used to create a building that fits into its local context with ease.

This year saw the launch of new category awards: the Galvanizing in Architecture winner was Consort Road, Peckham; the Galvanizing in Engineering winner was Singing Ringing Tree, Burnley; the Galvanizing in Detail winner was Briery Meadow Arbour; and the Duplex award went to Emanuel School, Wandsworth.

Sustainability seminar will outline a steel success story

One of the UK's most sustainable buildings has been successfully delivered to the UK Border Agency (UKBA) in Sheffield and a free seminar on 17 September will outline how the project team set about the task.

Part of the Corus Framed in Steel series, the morning seminar on Vulcan House will hear from the client, design team and key contractors involved in construction of the building that has been awarded a BREEAM Excellent rating.

Vulcan House is a seven storey, steel framed office building commissioned by the Home Office; the design brief was to exceed current requirements for new government buildings as the public sector strives to reach carbon neutrality targets. The building has also become a test bed for the UKBA which aims to minimise its ecological footprint, measuring CO_2 emissions throughout construction, operation and eventual demolition.

The project team speakers include Mott MacDonald, project manager Drivers Jonas, main contractor Wilson Bowden Developments, architect Hadfield Cawkwell Davidson, structural engineer White Young Green, and steelwork contractor Robinson Construction.

The seminar will be held at the Hilton Hotel, Sheffield. Numbers are limited and anyone interested in attending the Framed in Steel: Vulcan House seminar should visit: www.corusevents.com

Vulcan House was the first building in Sheffield to receive a BREEAM Excellent rating.

New steel production hub

Peddinghaus has officially opened its new US production facility in Bradley, Illinois. Erected in just five months, the company said that all of the structural steel used in the building was fabricated on its equipment.

With nearly 400 employees working at this multi-million dollar investment, Peddinghaus said it will ensure a continued high level of quality and service.

To celebrate moving into the new factory Peddinghaus will be holding an Oktoberfest event from September 24-27 with an on-site trade show, including the opportunity to view four new Peddinghaus machines. For more information email: Nick-Hajewski@peddinghaus.com

Dublin's complex convention centre on the rise

Steelwork contractor Fisher Engineering is currently erecting 8,000t of structural steelwork for Dublin's National Convention Centre.

Situated in the docklands area of the Irish capital, the building consists of a 2,000 seat auditorium above two levels of expo hall space and basement car parking.

Adrian McCoy, Projects Director for Fisher Engineering, says the main structural challenge for the project is the requirement for a limited number of internal columns.

"The Expo halls have eight 800mm x 800mm fabricated plate internal columns, other than this the required open plan areas are accommodated by a series of long span trusses."

Steelwork is being erected around two concrete cores and is due to be complete by November 2008. The entire project is set for a 2010 completion.

Main contractor for the job is Construction Management Partnership, a joint venture arrangement between Treasury Holdings and John Sisk & Son, while Structural engineer is O'Connor Sutton Cronin.

NEWS IN BRIEF

BSI has published the National Annexes to BS EN 1994-1-1: 2005 Eurocode 4: Design of Composite Steel and Concrete Structures - Part 1.1 General rules and rules for buildings and BS EN 1994-1-2: 2005 Eurocode 4: Design of Composite Steel and Concrete Structures - Part 1.2: General rules - Structural fire design. Both contain the partial factors and other national determined parameters to be used for structures constructed in the UK.

The competition briefs for the **2008/09 Corus Student Design Awards** are now available from www.steel-sci.org. All undergraduates are eligible and there is a £5,000 prize for both the bridges and structures competition.

SCI will be hosting a conference for UK engineering academics on December 11/12 at the University of Birmingham Conference Park. For more information contact s.gentle@steel-sci.com

Rhyl based steelwork contractor **EvadX** has achieved integrated registration to all three QUENSH standards: BS EN ISO 9001, BS EN ISO 14001 and BS OHSAS 18001.

A second spreadsheet to help designers with Eurocode designs has been added to the members' area in **Steelbiz**. It contains functions to calculate χ for flexural buckling χ_{LT} for lateral torsional buckling

The **American Institute of Steel Construction** (AISC), the BCSA's North American sister organisation, will hold its annual construction conference and exhibition in Phoenix, Arizona from April 1-4 2009. For more information visit: www.aisc.org/nascc

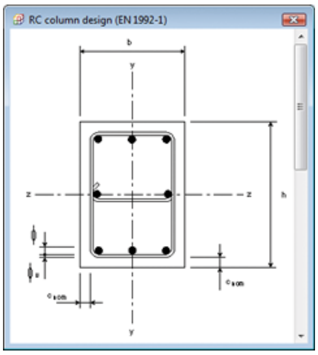
Eurocode calculator now available

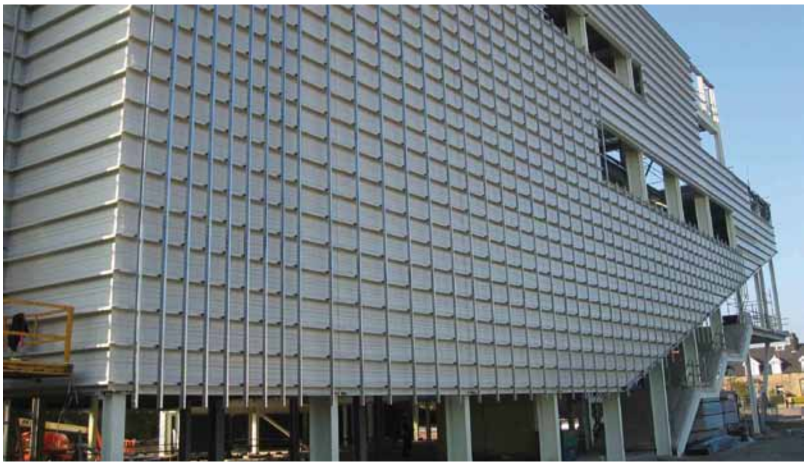
The first TEDDS Eurocode calculation is now available from CSC. RC column design (EN 1992-1) for designing braced and unbraced, slender and non slender rectangular columns to EN 1992-1: 2004 and the UK National Annex to Eurocode 2 are now obtainable from the TEDDS update service.

The calculation will check the capacity of the specified column against the specified axial load and end moments, produce the interaction diagram about both axes for the specified column and determine the design bending moments for the specified column, axial load and end moments.

The calculation will also consider effects of biaxial bending, while column effective length may be input directly, calculated from end restraint factors, calculated from predetermined end rotational restraint flexibilities, or calculated from the adjoining beam/slab geometry in accordance with PD6687: 2006 - Background paper to the UK National Annexes to BS EN 1992-1.

Minimum cover for bond and fire resistance is determined automatically.





Framing system brings project in on budget

Edinburgh's Jewel & Esk College twin campus development was recently faced with a serious funding problem with an identified shortfall of £14M.

A number of cost saving measures have been implemented to deliver the project on budget, including the use of the StrongBak SFS Structural Wall Framing System developed and manufactured by Architectural Profiles.

Architects RMJM said: "It is the StrongBak system, spanning directly between the main structural steels, which has allowed us to sheen over the buildings as fast as possible in terms of accelerating wind and water tightness."

Diary

For all Corus events visit www.corusevents.com email events@corusgroup.com tel: 01724 405060
For all BCSA events contact Gillian Mitchell tel 020 7747 8121 email: gillian.mitchell@steelconstruction.org

16 September 2008
Preparation for Eurocode 3
SCI course – Dublin
Contact: Sandi Gentle.

18 September 2008
Floor Vibrations
SCI course – Dublin
Contact: Sandi Gentle.

24 September 2008
Design of Steel Bridges
SCI course – London
Contact: Sandi Gentle.

30 September 2008
EC3 The major changes
SCI 4 hour course – Croydon
Contact: Sandi Gentle.

7 October 2008
Steel: The Show
Angel Hotel, Cardiff.
Free

7 October 2008
EC3, Understanding the Essential Principles
SCI 2 day course – London
Contact: Sandi Gentle.

8 October 2008
Steel: The Show
Thinktank, Birmingham.
Free

8 October 2008 (PM)
Slimdek Workshop
Thinktank, Birmingham.
Free

21 October 2008
Portal frame design
SCI course –London
Contact: Sandi Gentle.

29 October 2008
NOTE AMENDED DATE
Steel: The Show
Hampden Park, Glasgow.
Free

29 October 2008 (PM)
Slimdek Workshop
Hampden Park, Glasgow.
Free

28 October 2008
CE Marking Conference:
Institute of Directors,
Pall Mall, London.
Contact: Gillian Mitchell

12 November 2008
Steel: The Show
Sprowston Manor, Norwich.
Free

18 November 2008
EC3 The major changes
SCI 4 hour course – Nottingham
Contact: Sandi Gentle.

25 November 2008
Preparation for Eurocode 3
SCI course – Manchester
Contact: Sandi Gentle

27 November 2008
Steel: The Show
Cavendish Convention Centre,
London.
Free

27 November 2008 (PM)
Slimdek Workshop
Cavendish Convention Centre,
London.
Free

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T: 01344 636544 or email *Education@steel-sci.com*


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With the ever-increasing cost of raw material, using less of it makes good sense.
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Do I want to use less resources?
Tick all your Clients' boxes.
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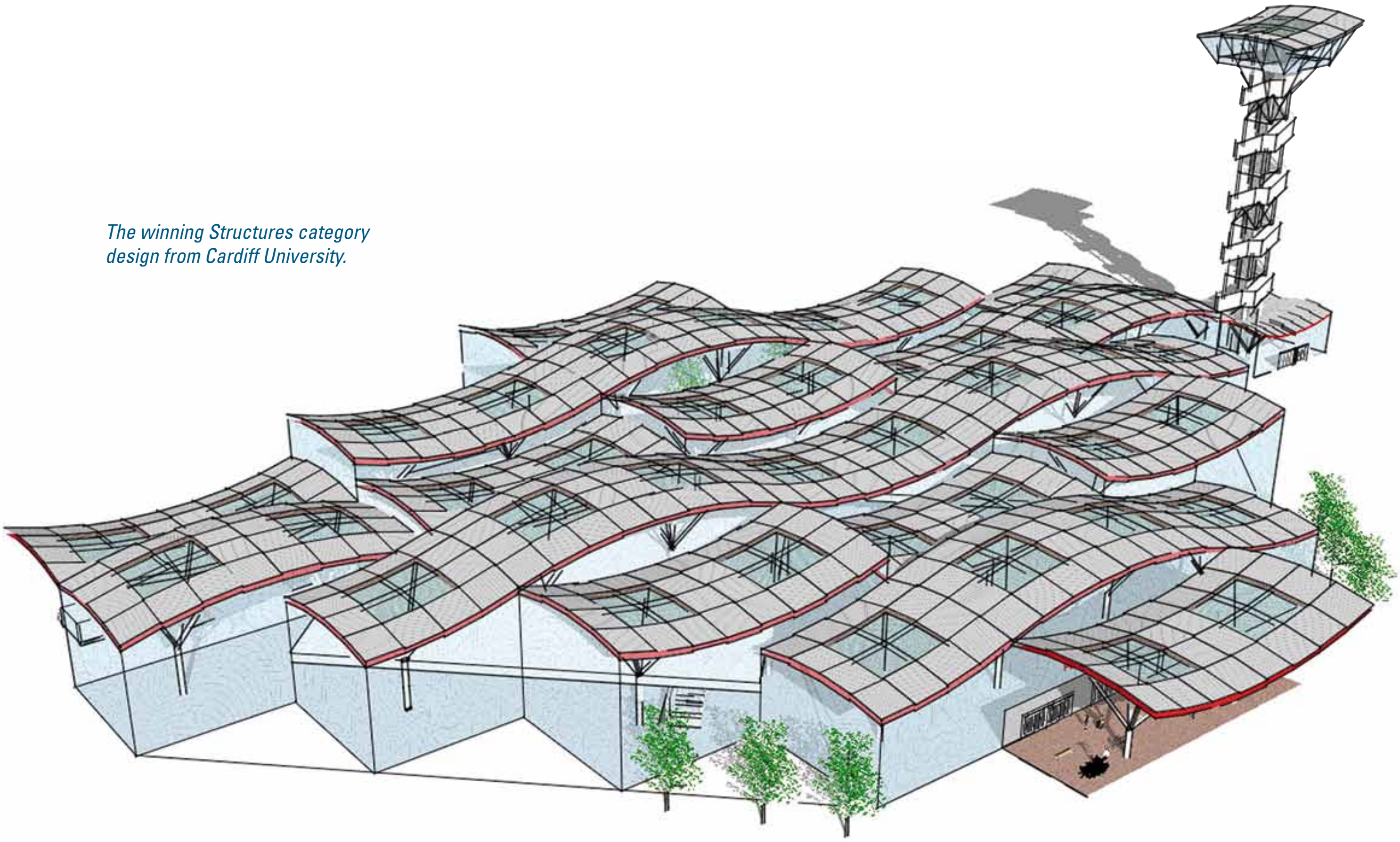
Tel: 01924 264121 Fax: 01924 280030 Email: design@westok.co.uk
www.westok.co.uk
ASD Westok. Part of the ASD metal services group.



The winning Structures category design from Cardiff University.

Corus Student Awards

A terminal building and control tower for a regional UK airport or a pedestrian and cycle bridge over a river were this year's competition requirements.

The Victoria & Albert Museum in early July was the stunning venue for this year's presentations for the Corus Student Awards.

As usual, the national awards were divided into two categories. The first - Structural Steelwork - required and challenged students to design a solution for a terminal building and control tower for a regional UK airport.

The second category - Steel Bridge Design - required students to design a pedestrian and cycle bridge over a river and dual carriageway to link a city centre regeneration scheme.

The shortlisted entries for the Structures category were the University of Nottingham, which the judges described as an outstanding structural statement, achieved by simple, practical means, with complex architecture, which was tackled with relish; London South Bank University, whose entry displayed powerful graphical imagery of a simple grand space, and employed excellent structural considerations; and Cardiff University, who according to the judges submitted an excellent integration of architectural and structural concepts.

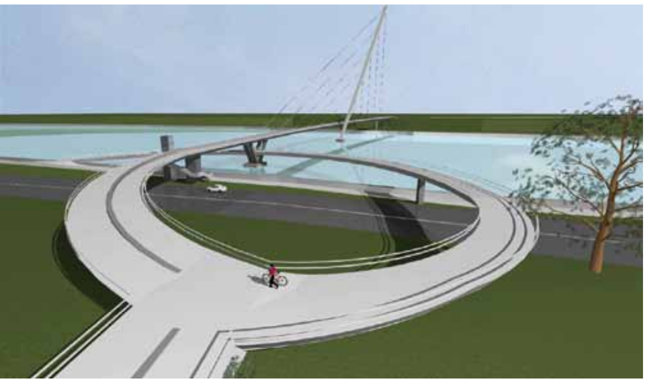
The judging panel for Structures was chaired by Alan Jones of SKM anthony hunts and he awarded the category top prize to Cardiff University student Matthew Wright.

Commenting on the winning entry Mr Jones, said: "The design was expertly thought out and comfortably lends itself to future expansion, while the control tower is well integrated."

Shortlisted entries for the Bridges category were

Right: The winning Bridges category team from the University of Southampton receive their award from Chris Dolling, Corus.

Far right: Structures category winner Matthew Wright flanked by Patrick Kielty and Alan Todd, Corus.



Above: University of Southampton's winning Bridges category design.

Anglia Ruskin University, an entry which the judges felt employed good design development, and gave thoughtful consideration to durability and maintenance issues; London South Bank University with an entry described as 'exciting to the point of being scary'; and the winning entry from the University of Southampton.

The judging panel for the Bridges award was chaired by Barry Mawson of Capita Symonds and commenting of the winning entry he said: "The University of Southampton provided a dramatic, integrated solution, which combined elegant design with excitement for potential users. Good hand calculations were presented alongside computer modelling, and the project drawings were excellent."

The winning team from the University of Southampton consisted of students Marcus Alexander, Toby Rand, Philip Reid, Philip Wildbore and Paul Salter.

Alan Todd, Corus General Manager was also impressed with this year's entries and said: "Corus is committed to fostering and developing the engineering and architectural talent of the future. All the successful teams demonstrated their design skills in an innovative and effective way, painting a positive picture for the future of steel construction.

"We are proud that the competition is now in its 20th year and look forward to supporting more students in the future."

Architectural award announced

At the same ceremony at the Victoria & Albert Museum the Corus Student Awards for Architecture were also announced.

The competition brief, entitled 'Living with waste' required entrants to consider sustainable waste use and management in a small urban community.

First prize went to University of Nottingham student, Li Gan, whose design for an urban housing community took into account aesthetics as well as sustainability issues.

Chair of the Judges Chris Nash of Grimshaw said the standard of entries was generally inspirational and Nottingham's design showed how practical and elegant solutions to waste can be easily integrated into everyday life.

"The design provided a beautifully drawn response to the brief, addressing the issue of waste usage and taking steel as a sustainable material into account."

Other shortlisted entries were the Politecnico di Milano, whose design, according to the judges, was elegant and practical with good consideration of energy reduction and resource use; and two teams from the Manchester School of Architecture - the first was an interesting take on the New York loft idea and the second attempted to integrate the cycle of waste into the everyday functioning of the building.

Steve Thompson, Senior Architect at Corus and judging panel member, said: "The student awards is a celebration of excellence in architecture rewarding talent and encouraging debate on the global issues that will undoubtedly affect the way that we design buildings in the future. Corus strongly believes in supporting the next generation of architects and this competition is part of a portfolio of initiatives that will give UK and international students the encouragement they need."

Above: Li Gan's intricately drawn design.

Left: L-R; Patrick Kielty; Bradley Starkey, Lecturer; winning student Li Gan; Alan Todd, Corus.

Steel tops new London college

FACT FILE
Lambeth College Clapham Centre, London
Main client: Lambeth College
Architect: BDP
Structural engineer: Faber Maunsell
Main contractor: Osborne
Steelwork contractor: Allslade
Steel tonnage: 235t
Project value: £14.5M

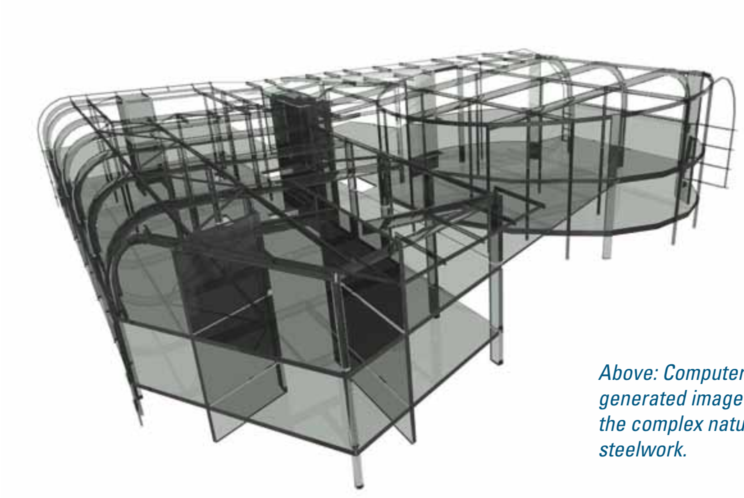
Above: The top floor and roof of the new college building consists of a 235t steel structure.

A highly visual and architecturally driven steel roof structure is the crowning glory of a multi-million pound college redevelopment in south London.

South London's Lambeth College has embarked on its first phase of the redevelopment programme for its existing estate. This involves the construction of a new £14M sixth form building and entrance structure at the Clapham Centre.

The project began in early 2007 and will provide state-of-the-art teaching accommodation and a performing arts facility in an eye-catching and imposing five storey structure.

Main contractor Osborne won a design and build contract in late 2006 and started on site in March 2007. The initial work involved demolishing an existing 1960s two-storey administration block and an auditorium. This cleared the ground for the construction of the new 6,350m^2 structure to begin.



Above: Computer generated image showing the complex nature of the steelwork.

The new building consists of a post tensioned concrete structure up to the fourth level, above this the uppermost [fifth] level is formed by and topped with a complex and challenging steel roof structure.

The roof is curved and wraps around the building on two elevations, north and south. It also slopes inwards towards a central gutter line.

"It's a highly architecturally driven roof which folds around the structure and supports the walls and cladding," explains Peter Russell, Osborne's Construction Manager. "The two pitches of the roof, either side of the gutter line, are also different, adding to the overall complexity."

The project's design team chose steel for the roof structure because of the complex shape and structural engineer Faber Maunsell and steelwork contractor Allslade had a number of meetings to finalise the challenging geometry.

"It's a highly architecturally driven roof which folds around the structure and supports the walls and cladding."

Between the two project team members a number of 3D computer generated models were made to help visualise the structure. Allslade then generated its own 3D model using design team drawings, which helped work out the geometry in the most complex areas.

"The upper part of the project is more organic in steel," comments Gary Chesher, Faber Maunsell

Above: Impression of the completed college building and its glazed atrium.

Regional Director. "The design and construction of the roof probably wouldn't have been possible without computer design packages and the use of steelwork."

Chris Gatehouse, Allslade's project Draughtsman, agrees and says: "In terms of design, the project as a whole was challenging, particularly the roof."

The roof structure was primarily formed with curved eaves rafters which carry a cladding system supported on purlins, this then continues over the radius from the vertical cladding to form the roof.

Precambered 686 x 254 x 140 beams support 4m tapered cantilever roof members. "The tapers for these members were developed by us using cladding details," explains Mr Gatehouse. "The taper angle had to continue over the eaves radius, which was made more difficult as the gable line also tapered in plan."

The upper part of the structure also needed architecturally sensitive bracing connections for the steelwork. The bracing for the roof structure also transfers the wind loads down to the fourth level of the building.

"The shape of the structure basically dictated the roof design and so there is no vertical bracing and only horizontal bracing," says Mr Chesher. "The roof on the east elevation overhangs to deal with wind uplift, the depth of the steel members had to be slender but robust to deal with this and required a complicated model during the design stage."

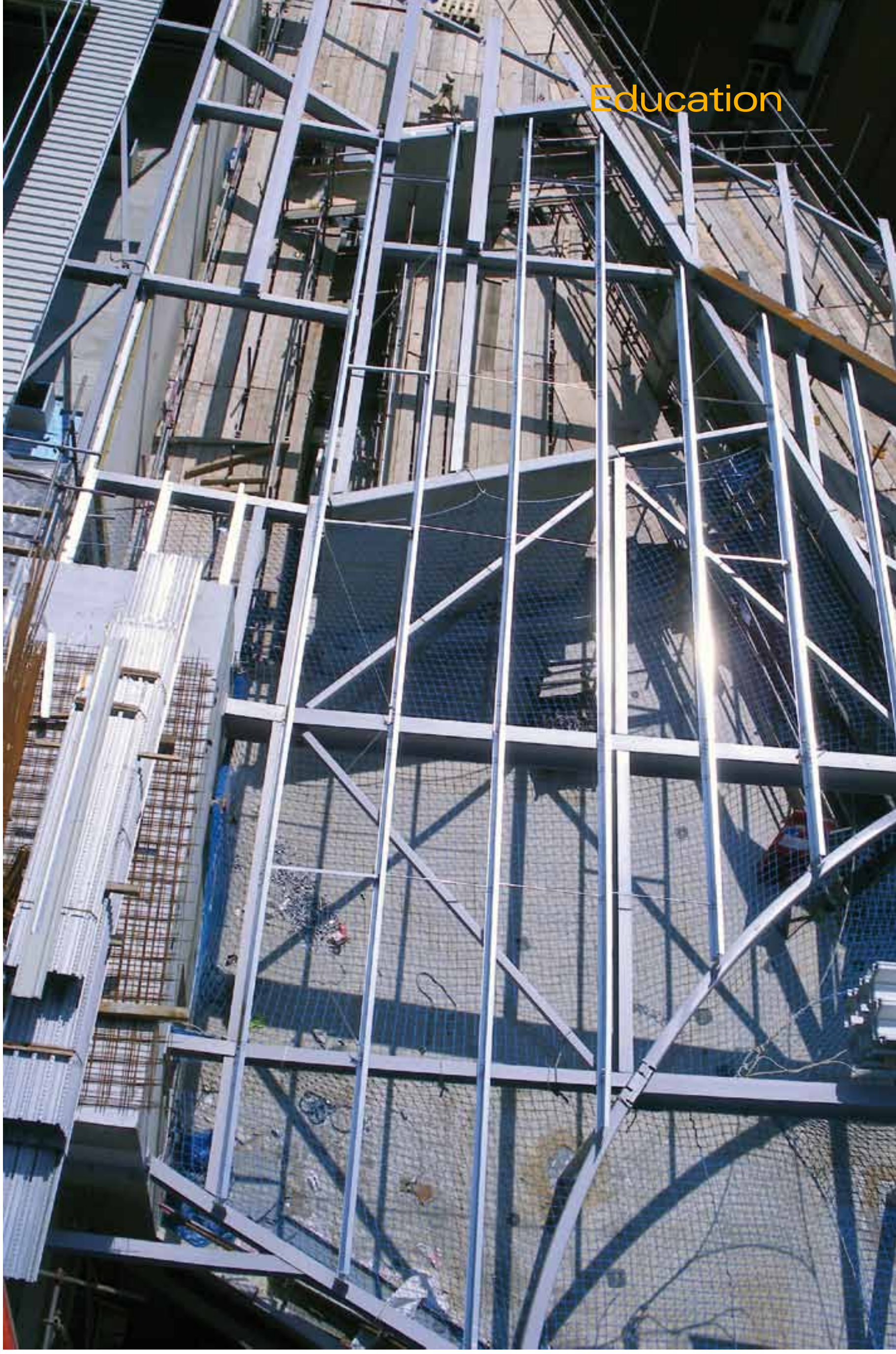
The roof structure is also formed with eliptical rafters and cantilever bracing members to the gable ends. The cantilevers of the roof also required moment connections and thermal packs, as these steel to steel areas are outside of the vapour barrier and needed to be thermally isolated.

Within the roof there is an open area known as 'The Artists' Garden' and this is intended to be a student breakout and learning area for 16-18 year olds studying creative art. Below this area there is a structure high atrium - clad with glass - which is supported by a lightweight steel facade within the overall concrete form.

This curved area was formed with perimeter 250 x 150 x 10 RHS members, which also follow the four degree pitch of the roof. Here there are many steel to concrete connections and these had to be fixed within the 30mm wall finishes.

The atrium has two steel link bridges, one at third floor level and another at the first floor which is suspended from above by Macalloy bars.

Allslade finished its steelwork erection programme earlier this year and Osborne's work will be completed in March 2009, with the college facility opening for the following autumn term.



Above: Architecturally sensitive bracing connections were needed for the roof's steelwork.

Commenting on the overall scope of the works, Mr Russell says a major challenge has been working in a college which has remained open throughout the works programme. "At the back of the site, the main college facility is open and the main entrance runs right through our working area," he says.

"The main entrance runs right through our working area."

Osborne has constructed a temporary roof over the entrance allowing students safe access and ingress to the college, while a new steel framed entrance foyer has now been completed. The new entrance will link directly into the new structure and allows for later redevelopment of the remaining old college buildings.

Another challenge for the main contractor has been the variety of different materials being used on site. "It's a very tight envelope and we are using steel, concrete and for cladding, render, brick, timber Brie Soleil and zinc," concludes Mr Russell.

Lights, camera and action

On a former dockland site in Salford, Media City UK will accommodate the BBC as well as other major broadcasters, large media corporations and a myriad of smaller creative businesses. Martin Cooper reports on the part steel is playing in a project that will deliver a major boost to the local economy.

The requirement for large open areas was one of the main reasons steel was chosen for this building.

The site is huge, covering an area of 16 hectares and currently a hive of activity and awash with an array of construction plant and workers. By 2010, however, this site will have been transformed into the UK's first purpose-built media city; an internationally significant hub for the nation's media and creative industries with five BBC departments at its heart.

Located next to the Manchester Ship Canal in Salford, Media City represents the first phase of a redevelopment project which could eventually include much more canalside land, so great is developer Peel Holdings portfolio of land in the area.

The Media City development will include three BBC office blocks, other speculative offices, a hotel, residential blocks, a 2,000 space multi-storey car park, a new dedicated Metro tram link and a large public realm surrounded by shops and restaurants.

The building with the largest footprint - 12,500m^2 - and at the centre of the project, is a large steel framed studio building with two conjoined towers, one a 16-storey hotel and the other a 19-storey office development.

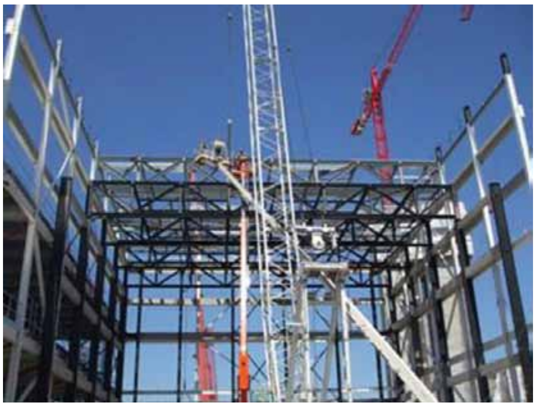
Steelwork contractor William Hare will at the end of its 56 week programme have fabricated, supplied and erected more than 7,000t of structural steelwork for this large and imposing edifice.

Founded on a combination of DCIS and CFA piled foundations, the building will house six large and three smaller production studios - three for the BBC, including one for the BBC Philharmonic Orchestra and three for other broadcasters - and it is centred around a central corridor which separates the two rows of studios.

These broadcasting studios vary in size, with spans from 24m up to 32m. They are all up to 26m high, which is the full height of the building.

The requirement for large open areas was one of the main reasons steel was chosen for this

FACT FILE
Media City UK, Salford Quays, Greater Manchester
Main client: Peel Holdings
Architect: Fairhurst Design Group
Structural engineer: Jacobs
Management contractor: Bovis Lend Lease
Steelwork contractor: William Hare
Project value: £415M
Steel tonnage: 7,000t



Above: Roof level trusses allow large open spans.

Below: A central corridor separates two rows of studios.

Above: The studio building and its two towers are the project's centrepiece.

Below: Continuity and acoustics were significant reasons for using steel.

Bottom: Image of the completed studio building.

building, explains John Hyne, Project Director for management contractor Bovis Lend Lease.

"We looked at all framing possibilities for each individual building and steel was the best option for the studio, not just because of the spans, but also acoustically," he adds.

Stephen Lamb, Jacobs Project Director, agrees: "The size of the studios meant steel was the only realistic option." As for the two towers, he adds: "They are the same structure as the studio on the bottom three levels, so it made sense to use steel for them as well."

Continuity apart, what also played a major part in the decision to construct the towers in steel was the need to maximise floor to ceiling heights, which then led to the Corus Slimdek system being used, a combination of ASBs and CF225 deep decking.

Meanwhile, to accommodate the large spans and column free areas of the studios, a series of large trusses are being erected at roof level. These large sections are all 2.8m deep and brought to site in two pieces. They are then bolted together on the ground and lifted as one large section.

Studio C (one of the BBC studios) is the largest of the studios and this facility has a total of 18 trusses based on a 7m grid pattern. The 2.8m depth of the trusses is then used to accommodate the vast array of necessary services. Interestingly, the proximity of the Ship Canal and associated quays means the surrounding waterline is literally feet below the project's structures and basically prevents any basements or any large services channels below ground. At roof level and supported on the trusses, each studio also has a plant room.

To accommodate the large spans and column free areas of the studios, a series of large trusses are being erected at roof level.

Isolating each individual studio was necessary to stop noise entering and leaving the facility.

"Each studio is effectively a semi independent structure," says Mr Hyne. "They all comprise concrete encased steelwork beams, upon which dense blockwork panels are constructed. All columns are based on acoustic bearings which segregate the studio from the foundations."

The overall structure has five concrete cores, three in the 19-storey office block and two in the hotel tower. These provide the stability for the tower blocks, but the studio area derives its stability from internal bracing. Most of the bracing is housed within the internal walls of the central corridor which acts as the structure's spine.

The back elevation of the studio building houses a large loading bay, able to accommodate three trucks at any one time. The loading bay is located within a large 2.5m cantilevering facade and a large transfer structure, consisting of steel trusses, needed to be installed.

Meanwhile, the front elevation of the studio building contains a large open area which could be used as a public space and for exhibitions. This area also contains a mezzanine level which has three smaller studios for general usage.

Approximately 2,000t of the structural steelwork will be erected for the two towers. Both of these semi-independent structures are centred around concrete cores and each is being constructed with internal spans up to 9m.

Acoustics have also played an important role in the steelwork construction of these areas as well. The 92m-high office tower has predominantly 406 x 356 x 634 columns, brought to site in approximately 6m lengths. These heavy sections were specified as they best aid the sound insulation requirement for each individual floor. In the 68m-high hotel tower, acoustics were not viewed as such an important issue and so slightly lighter sections - 406 x 356 x 287 columns - have been specified.

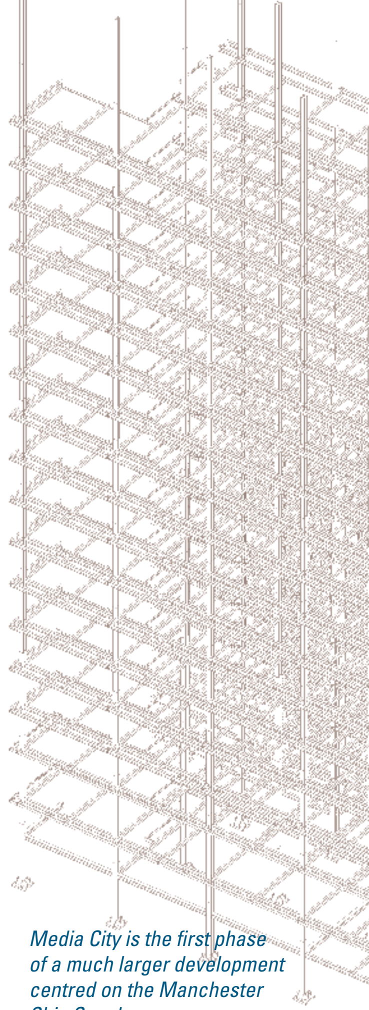
Erecting all of this steelwork has required William Hare to bring a number of crawler cranes to the site. These machines are erecting the majority of the studio steelwork, while on-site tower cranes are being used to complete the concrete cores.

"By the time the cores are complete both mobile and the tower cranes will then be used to erect the tower's steelwork," explains Mr Hyne. "Due to programming, the concrete team were on site first and the cores have to be completed, with cast-in plates to accept the steel beams, before the steel erection on the towers can begin."

Heavy sections were specified as they best aid the sound insulation requirement for each floor.

When the project is completed in 2011, approximately 1,500 London-based BBC posts will relocate to Salford Quays and an estimated 800 staff, currently based at the BBC in Manchester will join them on the new site.

Media City will deliver over £200M in additional net value added each year. It is also estimated that it will attract private investment of over £300M in the first phase alone, provide space for an estimated 1,150 media, creative and related businesses and provide employment opportunities for 15,000 people.



Media City is the first phase of a much larger development centred on the Manchester Ship Canal.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Town centre enhanced with steel

The curved entrance hall of the five screen cinema complex.

The Oxfordshire market town of Witney is being transformed as a new retail and leisure development takes shape on a three hectare site formerly occupied by a car park and a local football ground.

FACT FILE
Marriotts Close Development, Witney, Oxfordshire
Main client: Simons Developments
Architect: WCEC Architects
Structural engineer: BWB Partnership
Main contractor: Simons Construction
Steelwork contractor: Caunton Engineering
Steel tonnage: 1,100t
Project value: £40M

Witney's local authority currently estimates that around 80% of local residents travel outside the district to do their shopping. Although not a large town, there is enough available space for development and the aim of the Marriotts Close project is to enhance the commercial vitality and viability of Witney town centre.

Another important consideration for the scheme is to preserve and enhance the historical character of the town centre. This has been largely achieved by restricting the new structure's heights (five levels maximum) in keeping with the surrounding area and by designing the elevations to resemble individual structures.

Using various masonry and cladding materials will help break up long elevations and will lend the scheme a mock-Georgian feel. Also, by constructing three separate buildings the complex is open to the elements and resembles a traditional street.

Overall Marriotts Close consists of three separate and structurally independent buildings: a five screen cinema complex and two retail blocks. The development will also include a five level steel framed car park, currently being erected under a separate steelwork contract.

The two retail blocks consist of a two-storey composite steelwork podium over which two floors of timber framed residential units will be built.

The need to reduce the weight on piled foundations was one of the reasons why steel was the choice for the main framing material, explains Dave Hurst, Associate Director of BWB Partnership. "Steelwork is obviously robust enough to support the timber framed residential blocks, while the scheme's two anchor stores required long internal spans which is easiest with steel beams."

The main retail and leisure section will require 1,100t of structural steelwork which Caunton Engineering is fabricating, supplying and erecting over a six month programme.

"The steelwork erection hasn't been a continuous programme," explains Caunton's Contracts Manager Gareth Skelton. "We've actually erected one structure at a time and then returned to site once the ground was piled and ready for the next building."

The two level cinema complex was the first structure to be erected on the project. The building houses five screens, all of a different size, while the second floor houses the plant areas and projector rooms.

"The cinema has a curved entrance area and this involved installing a lot of small sections," says Mr Skelton. "Other than this the main challenge was to accommodate the necessary spans for the screens."

The largest span in the cinema complex is 22m and the smallest is 8m. Metsec lightweight lattice trusses have been used throughout and these are all 1.5m deep.

As the cinema is situated at the back of the project and bounds nearby residential properties the

Above: The M&S store has been built with two levels of Fabsec beams.

Left: Impressions of the completed project's streetscape.

need to keep this structure to a minimum height was essential.

"Structurally the biggest challenge was to keep the height of the cinema down while fitting five screens inside," explains Mr Hurst.

Retail unit A is the largest building on the site with a total retail floorspace of 371m² over two levels. Marks & Spencer has taken the majority of this unit and the client's wish to maximise floor to ceiling heights lead to cellular beams being used throughout the structure. Two levels of Fabsec beams with spans of up to 10m have been erected, totalling approximately 150t.

> *The need to reduce the weight on piled foundations was one of the reasons why steel was the choice for the main framing material.*

Unit A wraps around the new car park and forms one side of the project's main entrance with retail unit B directly opposite. The cinema complex is situated at the end of the main thoroughfare, directly in front of the development's entrance.

Retail unit B has a floorspace of 278m² and also consists of a two level steelwork podium with two floors of timber framed residential properties on top. Debenhams has taken the majority of this unit.

Stability for the three structures is derived from a combination of bracing and portal frames. "Because of the nature of the project we could only place bracing in certain areas, such as between cinema screens and shop walls," says Mr Hurst. "In other areas we had to make use of portalised frames."

Steelwork erection was completed on site at the end of August and the entire project is scheduled for completion by early 2009.

Education leads the way

A new steel framed college campus lies at the heart of a multi-million pound regeneration of Walsall, a scheme set to transform the West Midlands borough.

Photo courtesy of Shepherd Construction

The Walsall First project is a £750M public and private sector investment regeneration scheme which aims to deliver more than 5,000 jobs and 1,600 new homes for the West Midlands borough over the next 10 to 15 years.

At the centre of the scheme and the first project to get underway is the new Business and Learning campus for Walsall College. This campus has been designed to play a pivotal role in upgrading the skill base of local people and will feature highly equipped, specialised academies as Walsall seeks to move its economy firmly into the 21st Century.

The purpose built steel framed campus structure will offer 30,000m^2 of teaching and education space and steelwork contractor Conder Structures has recently completed erecting 1,400t of structural steelwork for the project.

Conder's Managing Director Jason Hensman, explains: "The main 145m long, curved steel, main college building will provide 4,800m^2 of space on each of its four levels. It has a central glass-fronted atrium, connecting the two four-level wings, and accommodates 300m^2 of flexible learning space above the main entrance."

The atrium rises to a height of 21m, and its 22m wide glass screen, forms the main hub and central focus of the college.

"New students arriving in September 2009 will

Above: A light steel frame was essential because of local ground conditions.

Left: Conder's programme was primarily completed with cherrypickers.

Below: Large Westok beams span the atrium.


Photo courtesy of Shepherd Construction

Above: The college forms the first part of Walsall's multi-million pound regeneration programme.

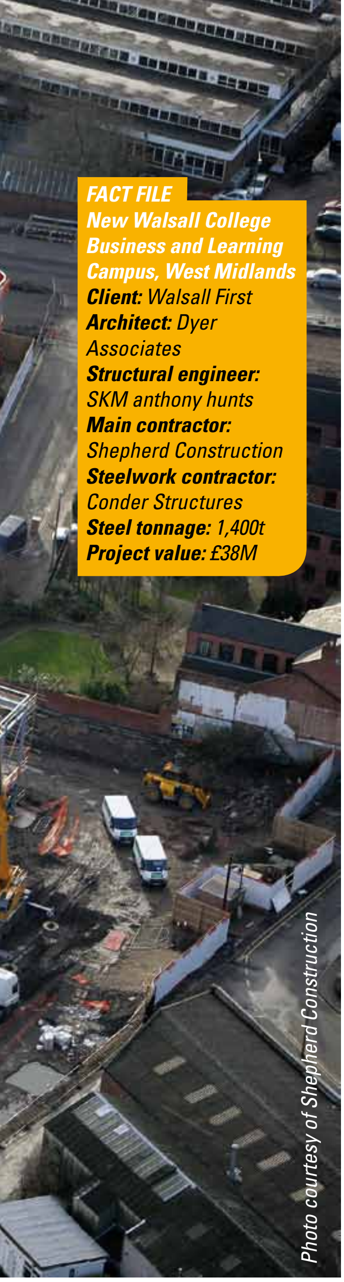


Photo courtesy of Shepherd Construction

FACT FILE
New Walsall College Business and Learning Campus, West Midlands
Client: Walsall First
Architect: Dyer Associates
Structural engineer: SKM anthony hunts
Main contractor: Shepherd Construction
Steelwork contractor: Conder Structures
Steel tonnage: 1,400t
Project value: £38M

Conder used just one mobile crane for its entire erection programme

be welcomed with reception and student services as well as a top-class refectory all on ground level," adds Mr Hensman.

The two separate wings forming the campus are connected across the atrium by six pre-cambered, spliced Westok cellform beams - the largest being 27m long and weighing 7.3t - which support the curved roof structure.

For the atrium beam connections, Conder designed special fin plate type linkages, using 75mm thick triangular steel brackets, each 2.5m long x 1.25m deep. These were bolted to the ends of the cellform members, sandwiched between two 40mm brackets and attached to the main columns by six bolts.

On the ends of the beams at the curved main building, six fixed bracket joints with 60mm round pins were used. At the opposing end of five of the rafters, the predicted expansion movement is achieved using 60mm square sliding pins. When the building is completed, these intricate movement joints will be hidden by a proposed suspended ceiling on level five and from the fourth floor.

The curved atrium roof extends beyond the glass screen and Conder designed 12 hidden connections for the exposed steelwork, using 200mm x 200mm box sections with cut away access hatches, unseen from below.

Highly compact connections were achieved with end plates on each tube, plus fins and angled cleats welded at Conder's yard, to the 16.25m long, 330mm diameter CHS angled columns, which slope at 80 degrees from their ground bases to the roof.

Conder's steelwork erection programme started in October last year and was aided by the fact that all groundworks had already been completed. The brownfield site had been levelled and piled in preparation for the steelwork to begin.

Conder used just one mobile crane for its entire erection programme which was primarily completed by early February this year. The company divided the project into five zones and erected steelwork in zones one and three first. These areas are the tips of the structure's two wings, and once complete Conder then linked them together by erecting the atrium zones.

For zones one and two of the main building, Conder undertook special design and fabrication of the floor beams - typically 300mm x 200mm RHS members - and soffits adjacent to the precast flooring units. The flat soffits provide natural ventilation, avoiding the use of air conditioning and heating equipment, with the floor slab acting as an effective heat sink.

On each beam, under every connection and soffit, 450mm wide flange plates, with full 8mm welds, were added so that each beam appears continuous through every column position.

"The 450mm wide plates also provide advantages for the connections on the box sections," explains Kevin Meers, Conder's Contract Manager. "The sections are too narrow for the end plate connections, with four bolts located within the section and four externally, but hidden from view above the flange."

The final zone to be completed was the automotive workshop which is an independent one-storey structure situated adjacent to the main college building. The building measures approximately 60m x 40m and required 60t of structural steel beams and columns.

"There are so many curves and intricate details that steel was the only solution."

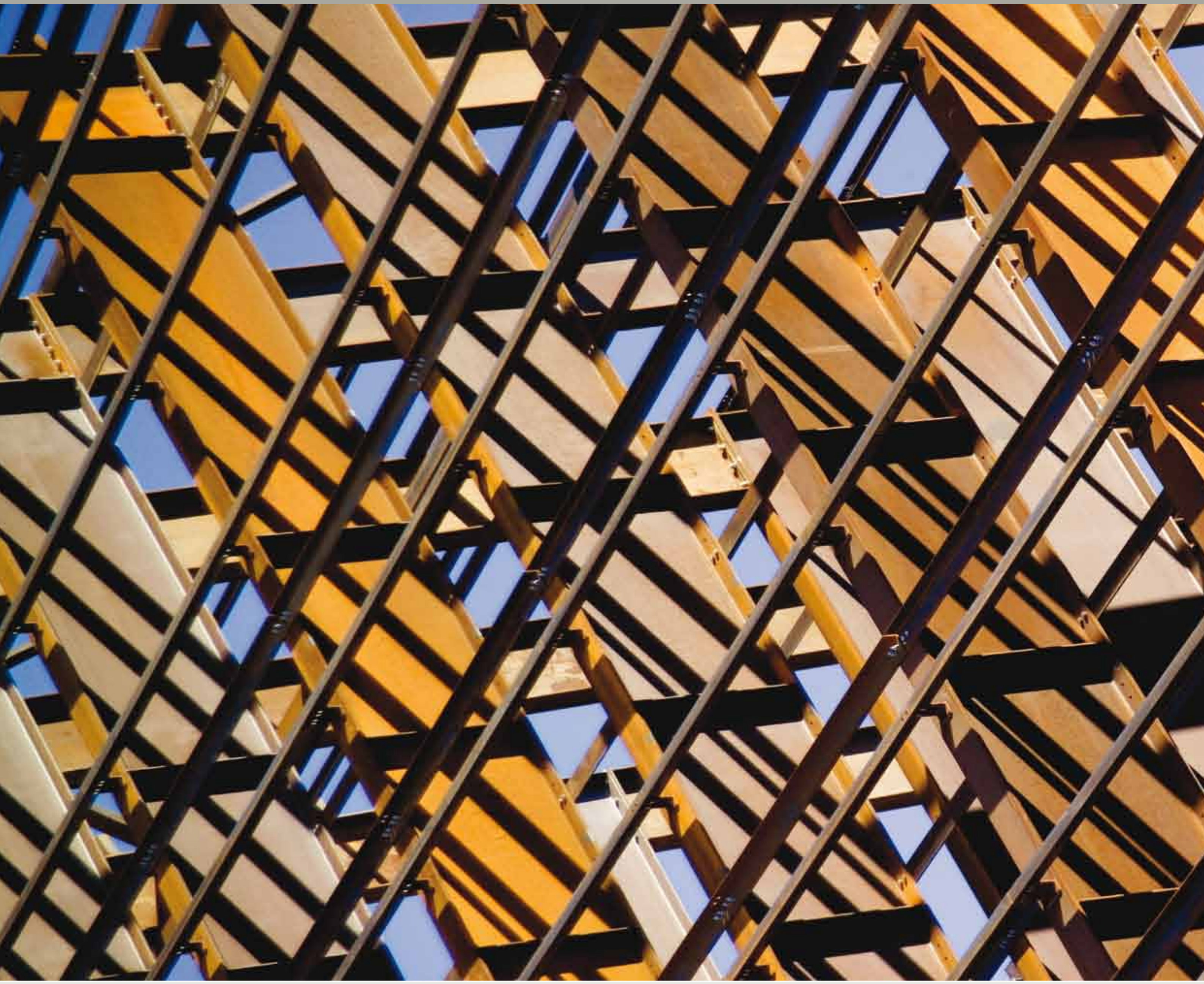
Structural stability throughout the project is provided by bracing located in stairwell and lift cores. These were the only locations suitable for bracing as the main elevations feature windows and doors along their entire length.

Commenting on this prestigious project, Shepherd Construction's Site Manager Dave Critchlow, says this project couldn't have been designed in anything other than steel.

"There are so many curves and intricate details that steel was the only solution," he adds.

Another aspect of the design which favoured the choice of steel was the fact that beneath the site there is a myriad of old limestone workings. These tunnels have been largely located and stabilised from above, but consequently the design did require the lightest structural frame possible, and this meant steel was chosen.

Walsall College's new campus is scheduled to open for the 2009 autumn term.



Steel. The sustainable facts

FOUNDATIONS. The ultimate environmental objective is to avoid leaving an unwanted legacy for future generations.

At the end of a structure's useful life, when a site is cleared, foundations are generally abandoned and left to be someone else's big immovable problem. Steel foundations have the potential for extraction, so a site can be returned to its original condition. The recovered steel will be reused or multicycled. During installation, steel driven piles do not produce spoil and require far fewer deliveries to site.

N O P Q R S T U V W X Y Z

To find out more about the material of the future visit **www.sustainablesteel.co.uk**

Adapting to a changing market place

In the second article in our Steel Supply Chain series, NSC examines the role of light gauge and floor decking manufacturers and the crucial part they play in the UK steel construction market.

Above: Lightweight steel products are suitable for a variety of steel projects including refurbishment jobs.

The next article in this series, about paints and protective coverings. will appear in the November issue of NSC.

Lightweight cold formed steel products are vital components for the majority of steel construction projects. Whether it is purlins, rails, walling, channel systems or floor decking systems, these products are ideally suited for most commercial and industrial applications, while a number of them have also been specifically designed for refurbishment applications. Lightweight structural products are used substantially in the steel frame, modular and refurbishment sectors and consequently they also have a high market share.

Floor decking

Most manufacturers of these products predominantly concentrate on either decking or a range of cold formed products. Supplying floor decking is something of a captive market, because although the products are used on all steel construction projects, there are only a handful of contractors which specialise in installing it. Most steel contractors will undertake decking as part of their overall steel package, but in reality they will often sub-contract the task out to a specialist.

On the manufacturing side of the sector, there are also not that many producers of decking and consequently they usually supply exclusively to one of the specialist installers.

Producers of floor metal decking also supply literature and software, free of charge, aimed at designers and explaining how to decide what the best option and product for their project is. Producers also actively study the market to find out what changes are afoot and what product updates are needed.

Environmental and health and safety legislation also plays an important role in new product design. Manufacturers of floor decking are no different from producers of any other product, in so far as they must adapt to an ever changing world.

Computer software is now playing an important role in ordering products.

Decking manufacturers also deliver their products to site for the installer to fix and erect. On a busy and often congested site, it is imperative that the correct amount is delivered, on time and to the right place.

Computer software is now playing an important role in ordering products. Most repeat customers will have access to a preferred manufacturers electronic order book which not only speeds up ordering but also ensures the exact amount and correct product is coming off the production line as soon as possible.

Another important service provided is the fact that manufacturers all have a team of sales managers on the road, visiting existing customers and also offering advice to designers that have not used their product as yet.

Advice on what product is best suited for an up and coming project is also available by either calling the manufacturer directly and asking for the sales department, or via a company's website.

Light gauge products

The light gauge sector is supported by a handful of UK based manufacturers. The difference here, compared to the decking market, is that these companies primarily sell direct to steelwork contractors. This is because purlins, rails and other cold formed items are part and parcel of a steelwork contractors erection programme.

Steelwork contractors may sub-contract out the erection process, but cold formed steelwork is invariably part of their overall erection package, the same as all the heavier structural steel members. Consequently it is the steelwork contractors that hold sway over this market sector as they decide what products are needed and when.

Repeat business is also widely seen as one of the most important aspects of the sector. Every manufacturer will ensure that every order is on time and consists of the correct sizes and product quantity, as return business means more business and makes for a healthy order book.

The UK steel construction industry is highly developed in the use of computer aided design and detailing methods. Drawings and details are increasingly transferred electronically between the steelwork contractor and the manufacturing site. The specific details of each component part of a structure is created through the use of CAD systems and fed through to the production line. This is a very fast and accurate system in an industry that is persistently looking for ways of reducing the build programme.

Recent fire testing has proven how safe these products are.

Light gauge steel products also form an integral part of the supply chain as they are often the last steel members to be fitted and so form the final part of an erection programme. On time delivery is therefore vitally important to ensure a project is on time and a customer - in this instance a steelwork contractor - is pleased and happy to use the producer's services again.

Above: Purlins form an integral element in steel roof construction.

Below: Decking manufacturers deliver their products directly to site.

All photography courtesy of Kingspan Structural Products.

Fire testing

Recent fire testing has also proven how safe these products are. Light steel load-bearing frames are widely used in buildings of up to eight storeys for which longer periods of fire resistance are increasingly required. It is important that the light steel and modular industries have economic solutions for load-bearing floors and walls to achieve fire and acoustic requirements to meet new regulations and modern design and test standards.

The introduction of the BS EN 1365 fire test regime has required an extensive programme of re-testing, as it is more severe than its predecessor due to the use of plate thermocouples. This is particularly important for 90 minutes fire resistance.

A recent fire test at the Building Research Establishment supported the applied load for 93 minutes, although the designated failure of the test was at 92 minutes in terms of the integrity criterion. Importantly, for the steel joists, their temperature remained at less than 100°C for over 80 minutes and so the joists would be essentially undamaged and re-usable, even after a severe fire. At 90 minutes, the joist temperature reached 280°C, at which point the furnace temperature was over 1,000°C. The mean temperature of the upper surface was less than 60°C, which was well within the 140°C limit for the BS EN test.

Recognition is given to the following companies which are supporting the BCSA/Corus steel construction market development programme

Light gauge and decking manufacturers:
Albion Sections
Composite Profiles UK
Hi Span
Kingspan Structural Products
Metsec
MSW Structural Floor Systems
Richard Lees Steel Decking
Structural Metal Decks
Structural Sections
Studwelders

Bi-Steel panels simplify and speed up construction of 49 Park Lane.

FACT FILE
49 Park Lane, London
Main client:
Pembroke Real Estate
Architect:
RHWL Architects
Construction Manager:
Mace
Structural engineer:
Buro Happold
Steelwork contractor:
Billington Structures
Steel tonnage: *512t*

Fast cores aid on-site craneage

A faster construction programme and an extremely tight site meant a number of innovative solutions were called for on a prestigious central London project.

The intricate design of a new building in central London meant that structural engineer Buro Happold needed to incorporate some innovative solutions. The use of Corus' versatile Bi-Steel panels and Corefast system has proven a valuable solution in the construction of 49 Park Lane.

The building, located near to the listed Dorchester Hotel, will stand eight stories high with an additional lower level floor. Being built for client Pembroke Real Estate, 49 Park Lane comprises 2,300m^2 of office accommodation and three adjacent residential apartments with a separate entrance.

The building was designed to include three Bi-Steel structures – two Corefast cores (made from Bi-Steel panels) and one Bi-Steel shear wall. "The site is narrow and so we were very tight for space," says Senior Structural Engineer at Buro Happold Julian McFarland. "The Corefast system allows us to use a smaller core in plan so maximising the floor space.

"The compact nature of the site also meant we needed to build as close as possible to the neighbouring buildings. A slightly different bolt system from the normal Bi-Steel panel fixings was used which allowed the Corefast modules to be assembled from one side only. This meant we were able to build the cores within millimetres of the existing structure."

Altogether a total of 512t of steel, including the three Bi-Steel structures, has been used on the project, all fabricated and erected by steelwork contractor Billington Structures.

"There was limited space on site to sit a tower crane for the construction," says Mr McFarland. "If a crane was on site, movement would have been restricted and it would have taken time to 'fill in' the gaps in the frame left from where the crane stood." So the project team came up with an innovative solution to sit a tower crane on top of a completed Corefast core.

The project team came up with an innovative solution to sit a tower crane on top of a completed Corefast core.

Corus designed a specialised 'crane saddle' which was cast into the top of the first core. The tower crane was then able to be lifted into place and bolted onto the saddle, enabling the entire steel frame and remaining Bi-Steel structures to be erected without the need for a crane on the ground.

The steel frame is a complex design, with transfer structures at second floor level around the perimeter of the building supporting steel columns. "The individual sections and connections were all standard but due to the size and shape of the site there are a whole host of different connecting members," explains Mr McFarland.

"The client wanted maximum floor space and ceiling heights and to achieve this steel was the most economic material to use. Beams spanning up to 9.5m were incorporated and cellular holes were included through the web to enable services to be passed through. If this was to be achieved using concrete, the floors slabs would have been much thicker and services would have been housed underneath, resulting in much lower ceiling heights and a heavier building with larger foundations."

The building has been designed to match the aesthetics of the surrounding historic buildings and is scheduled to be completed by April 2009.

Above: A tower crane was bolted to the top of a completed core to lift the remaining steelwork into place.
Below: A special bolt system for the steel core was required because of the compact site and the proximity of a neighbouring structure.

Table top construction

A new world class arena in Dublin's Docklands is being constructed from the shell of a former train shed. Martin Cooper reports on a project which has highlighted steelwork's versatility and speed of construction.

It started life in 1878 as a train depot, serving Dublin's busy port, and one hundred years later it was reborn as the city's premier music venue, hosting everyone from U2 to Britney Spears and even the Eurovision Song Contest on three occasions in the mid 1990s.

Today the Point Depot, now renamed the O_2 Dublin, is undergoing yet another transformation which will nearly double its capacity to 14,000 for concerts, and provide better front and back of house facilities to match any other international venue.

The O_2 is located in Dublin's Docklands, a fast-changing area, with many on-going construction projects, just a mile or so down the River Liffey from the city centre. Adjacent to the site is one one these large construction projects, the Point Village mixed use scheme (see NSC May 2008), which includes a new light rail terminus that will give concert goers easy access to the O_2 venue and the surrounding shops.

With an array of new steel and glass buildings going up all around, what makes this project different from other nearby schemes, apart from its complexity, is the partially retained facade of the original train shed structure. Simon Penny, Buro Happold Associate and Project Leader, explains: "Three of the structure's original brickwork walls have been kept, while a fourth was demolished, allowing a new steel framed interior to be inserted and the construction of a new and higher roof."

Fitting the new auditorium inside the three retained historic walls meant the original configuration of stage and seating had to be twisted by 90 degrees to get the best fit. All of the retained walls had to be propped while the new steelwork was being erected, and these props were not removed until the new steelwork had been fully connected into the brickwork.

Steelwork contractor Walter Watson installed stainless steel rods and channels along the retained walls and the new steelwork was connected to this. Within the walls nine original cast iron columns and 17 wrought iron beams have also been retained and incorporated into the new design.

> ***Fitting the new auditorium inside the three retained historic walls meant the original configuration of stage and seating had to be twisted 90° to get the best fit.***

"This is one of the interesting features of the project," says Mr Penny. "The way in which the modern steelwork has been combined with reused original wrought and cast iron beams and columns. This creates a modern venue which retains some of the heritage value of the original train shed."

While preparatory works were underway the building's original columns were all removed by Walter Watson and tested to make sure they were up to standard and had not suffered any damage over the years. All of the Victorian ironwork was

FACT FILE
O_2 Dublin
Main client: *Live Nation*
Architect: *HOK sport architecture*
Main contractor: *Walls Construction*
Structural engineer: *Buro Happold*
Steelwork contractor: *Walter Watson*
Steel tonnage: *2,900t*

Main picture: Four super columns and the linking trusses were initially erected, to form a structure resembling a table.
Top: The structure has two tiers of seating.
Above: Nearing completion, the O_2 Dublin will open in December.

found to be in good condition, and most have been reused in the new design.

"The old columns are all in new positions and we just had to add steel cruciforms to the tops to accept the new steelwork," explains Trevor Irvine, Walter Watson General Manager Structural Division.

Early in the design stage, a steel frame was chosen for the new arena due to the complexities of the bowl's geometry, the constrained site, the long auditorium spans and the programme advantages.

Because the site is tight, off site fabrication of the steelwork allowed the project to run two sites in parallel. The main project site was therefore clear for groundworks, piling and foundations to be completed, while the steel fabrication began at Walter Watson's County Down facility, one month before steel erection began.

The first steelwork to be fabricated and erected were four 'super columns' which provide the overall lateral stability to the structure and contain risers and lift cores (stability is also provided by the arena's rakers and braced bays around the structure's perimeter). These columns have some huge loads passing through them, 6,500kN on some of their connections and approximately 14,200 tension control bolts were used on just these columns and roof trusses alone.

Each 'super column' is located in a corner of the building, and their early erection allowed the linking roof trusses to follow promptly, and then the early overall enclosure of the structure and the introduction of follow on trades.

The initial steelwork within the retained walls resembles a giant table, explains Mr Irvine. "The super columns are the legs and the trusses form the table top. Approximately 800t of steel went into this phase."

The 27m high 'super columns' were brought to site in six pieces and assembled on site. The completed 100t columns were then lifted into position by two 350t capacity mobile cranes. Once positioned, a series of 54m long box and plane trusses were lifted into place linking the super columns. These 6.2m deep trusses provide the required 70m^2 of clear auditorium space needed to achieve the necessary improved sightlines.

"The roof steelwork was also suited to providing the additional flexible load capacity to allow event equipment to be supported in various configurations for future concerts," adds Mr Penny.

As well as the 'super columns', all of the roof trusses were fabricated as complete pieces and then taken apart so they could be brought to site. "This was one of the biggest challenges of the project," says Mr Irvine. "Working out the logistics of bringing such large steel sections to site and then re-assembling them."

In total there are three 54m long box trusses, all 6m deep and made from box sections at the top and UC sections for the bottom, and one 50t proscenium truss which is the same length and connects to a series of shallower trusses over the slightly lower stage roof.

Once the 'table' had been erected, the interior steelwork for the bowl began. A steel 'sandwich plate system' installed by Intelligent Engineering was used for the lower tier steppings, as an innovative lightweight alternative to precast terracing. This system incorporates a transfer beam and provides better sightlines, as fewer supporting columns were needed. Above this there is a second tier of seating constructed with steel rakers and precast terracing.

Trusses crop up throughout the project and three more were needed to create a column free loading bay area on the ground floor. This bay needed to be 5m high to accommodate trucks, which is slightly higher than the regular floor to ceiling heights within the auditorium.

"We had to use Westok Ultra Shallow Floor Beams (USFBs) in this zone to level out the floor heights," explains Mr Penny.

The new arena, which is scheduled to open in December, is a fine example of the advantages of steel construction, says Mr Penny. "It helped the main contractor achieve a challenging construction programme."

Above: Each super column was erected in six segments.

Below: Behind the retained historic facade the new venue will have a 14,000 concert capacity.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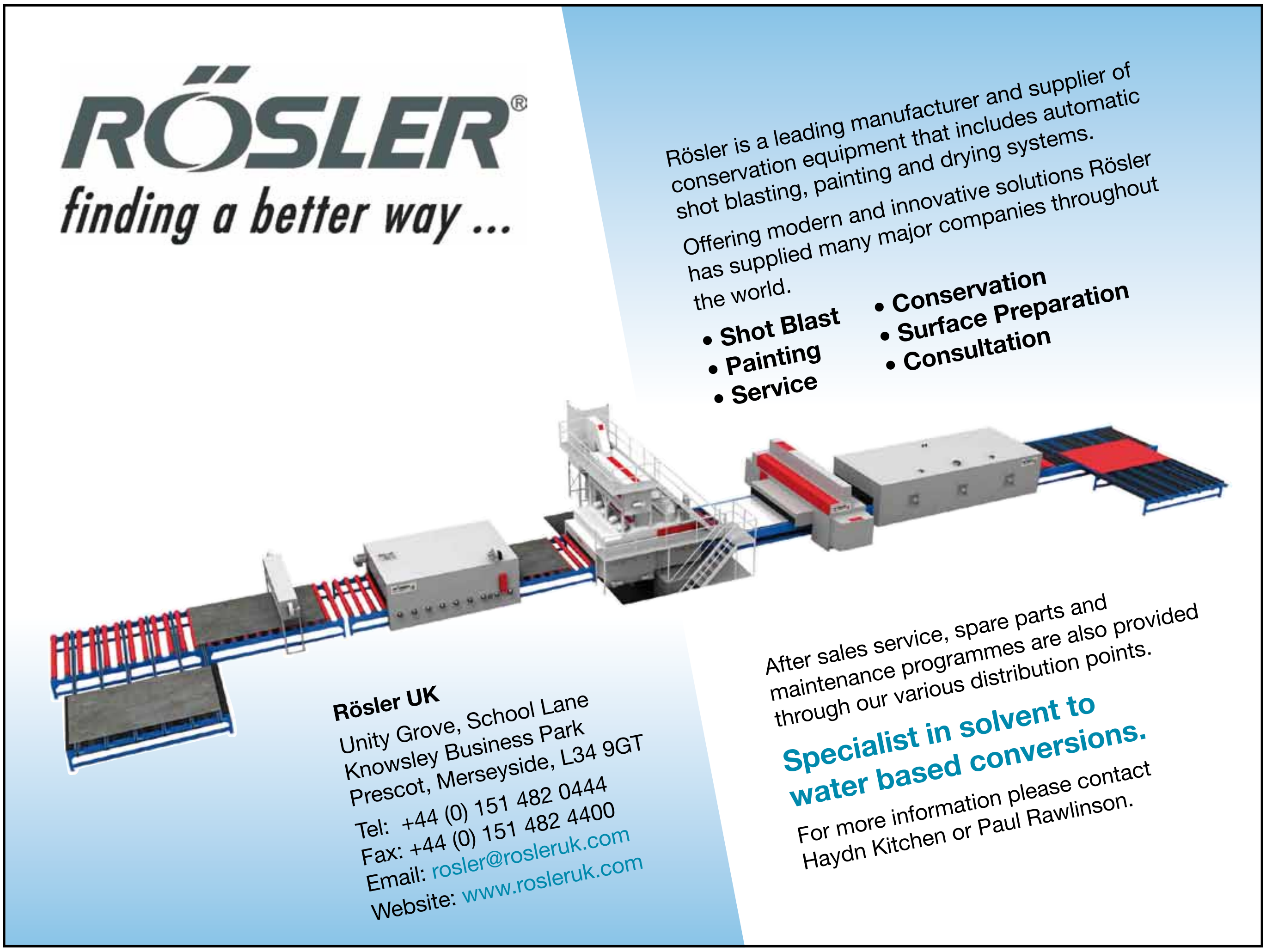
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Composite design to EC4 – some key changes

With implementation of the Eurocodes fast approaching, and the key National Annexes being published, it is worth starting to think about the differences between the new Standards (for composite buildings this is predominantly BS EN 1994-1-1, or Eurocode 4 Part 1-1) and previous guidance (predominantly BS 5950-3).

Introduction

This article will briefly look at the main differences between the two codes that will affect common designs in the UK. Construction stage design and the determination of loadings (or actions, as they are termed in the Eurocodes) are not covered, as they have been or will be covered by other articles on Eurocodes 1 and 3. Despite some fairly extensive guidance on the design of continuous composite beams within Eurocode 4 (EC4), these are also not covered as they are uncommon within the UK. The same applies to composite columns, although these may become more widespread once EC4 gains acceptance.

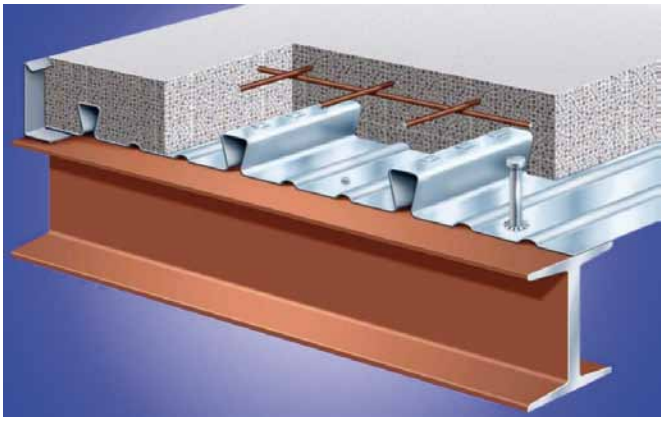

Figure 1: Typical composite construction

Applicable Eurocodes

The Eurocodes have been written on the basis that information cannot be presented in more than one part. This means that to design composite structures to the Eurocodes the Engineer will be required to reference not just Eurocode 4 Part 1-1[1], but also Eurocode 1[2] for the loading; Eurocode 2[3] for the concrete properties and some of the concrete related checks (such as longitudinal shear); Eurocode 3[4] for the construction stage design, the design of beams for shear, and the design of profiled steel sheeting[5]; and Part 1-2[6] of Eurocode 4 for the structural fire design. For each of these Standards, the National Annexes will also need to be referenced.

Notation

In common with the other Eurocodes, EC4 uses a number of subscripts such as *k* for characteristic values, *d* for design values, *R* for resistances (rather than capacities) and *E* for applied forces or moments. Specific to EC4 is the subscript *a*, which comes from the French word for steel, *acier*, and refers to steel components of the composite structure; for example, the shear resistance of the steel section is referred to as $V_{pl,a,Rd}$. The resistance of a shear connector changes from Q to P_{Rd}, and forces in the steel and concrete used when calculating the plastic resistance of a composite section become N_a and N_c. Among other changes, the depth of the concrete slab is referred to as h, and that of the profiled steel sheeting h_p.

Concrete

One of the most noticeable differences in EC4 is the way that concrete strength is treated. Concrete strengths are termed according to the shape of the moulds used to produce samples of the concrete for compression testing; in the British Standards, the cube strength is used, whereas the cylinder strength is used in the Eurocodes. At first glance, the strengths used in the two different Standards will give different resistances, as concrete with a characteristic cube strength of 25 N/mm² should have a characteristic cylinder strength of 20 N/mm². However, when converting from the concrete strength to the equivalent plastic stress block, the factors (0.67 and 0.85 for the BS and EC respectively) result in virtually identical design strengths.

For example, for design to the British Standards:
$0.67\, f_{cu} \div 1.5 = 0.45\, f_{cu} = 0.45 \times 25 = 11.25$ N/mm²
and for design to the Eurocodes:
$0.85\, f_{ck} \div \gamma_C = 0.85 \times 20 \div 1.5 = 11.33$ N/mm²

The modular ratios that are recommended in the Eurocodes are similar to those in the British Standards, but are concrete strength dependant. For a typical 25/30 concrete, the short-term modular ratio is 6.7 and for permanent loads is 29 (with an intermediate value for the primary and secondary effects of shrinkage). However, for frames which have $\alpha_{cr} > 10$ (meaning second order effects do not have to be taken into consideration), a value of twice the short-term modular ratio can be used for both short-term and long-term loading to simplify the analysis.

Shear Connection

In BS 5950-3, the characteristic resistance of headed studs in solid slabs is given for various combinations of height, diameter and concrete strength, but the physics behind the numbers is not presented. EC4 calculates the resistance as the minimum of two equations, shown here as (1) and (2). f_u is the ultimate tensile strength of the stud material, d and h_{sc} are the diameter and height of the stud and f_{ck} and E_{cm} are the cylinder strength and elastic modulus of the concrete.

$$P_{Rd} = \frac{0.8 f_u \pi d^2 / 4}{\gamma_v} \qquad (1)$$

$$P_{Rd} = \frac{0.29 \alpha d^2 \sqrt{f_{ck} E_{cm}}}{\gamma_v}, \quad \alpha = 0.2\left(\frac{h_{sc}}{d}+1\right) \le 1 \qquad (2)$$

The two equations represent different methods of failure of the stud, and these are shown in Figure 2. Equation (1) represents the force required to fail the stud itself in shear at it’s base, as shown in Figure 2 (a), while Equation (2) represents the failure of the concrete around the stud, which leaves a cone of concrete around the base of the stud, as shown in Figure 2 (b).

Figure 2: (a) (b)
Failure mechanisms of the headed stud shear connectors

In the majority of cases, equation (2) will dominate (the exception being when very weak steel is used for the shear connectors). Figure 3 shows the difference between the values used in the BS (solid) and the Eurocode (dotted) for a number of stud dimensions.

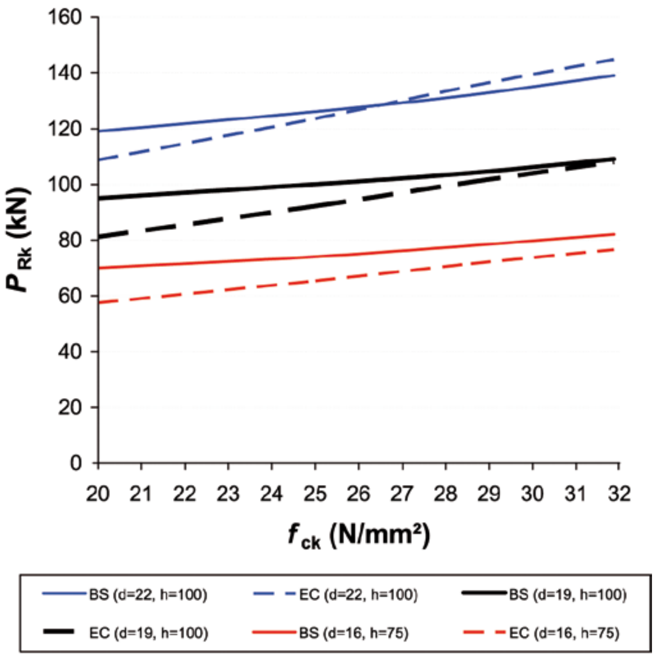

Figure 3: Characteristic stud resistance against concrete strength for various stud dimensions in solid slabs

The reduction factors that are applied to the resistance of the shear connectors when they are used with profiled decking are calculated using identical equations to those in BS 5950, but with a different constant coefficient applied (0.85 and 0.6 for singles and pairs respectively in the BS, 0.7 and 0.5 in EC4). This leads to a 17% reduction if the deck geometry is such that the limiting values do not apply. However, most decks commonly used in the UK are designed such that the limiting value dominates, so the reduction factor is independent of the geometry and is based only on the number of studs and the orientation of the deck. For the Eurocodes these values are the same as the BS for decks thicker than 1.0 mm, but about 15% lower than the BS for decks with a sheet thickness of 1.0 mm or thinner.

All of this together means that the resistance per stud in the Eurocodes is lower than in the British Standards, but although this will lead to a lower shear connection for a given span and stud spacing (which is usually governed by the deck profile), the shear connection rules in the Eurocode allow for lower degrees of shear connection at larger spans than the BS, as shown in Figure 4. As long span beams are often governed by serviceability considerations there will therefore be no penalty.

It is also worth noting that SCI is currently nearing the end of a major study into stud resistances with modern trapezoidal decks. This will provide values that are more appropriate than those given in either the current BS or EC4.

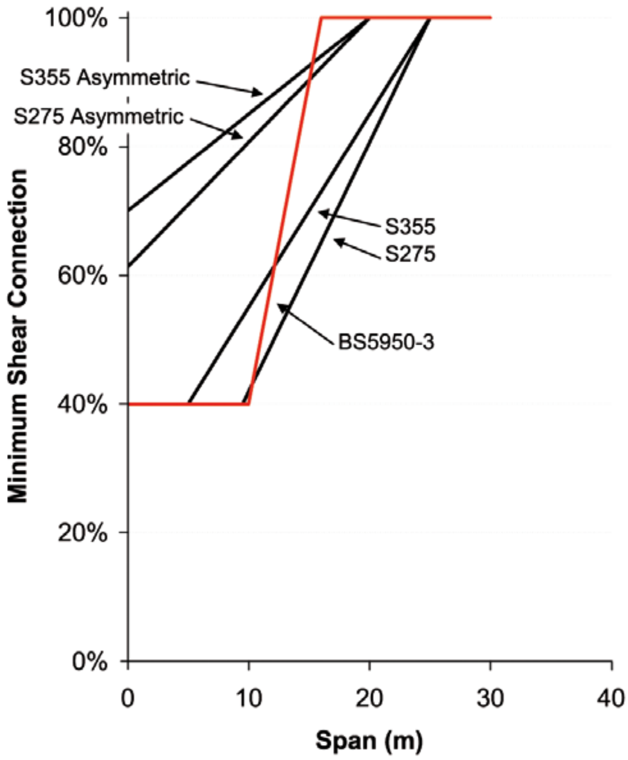

Figure 4: Minimum shear connection requirements from BS5950-3 and Eurocode 4

In the BS, the minimum shear connection depends only on the span of the beam, but in the Eurocode the steel grade and asymmetry of the steel section are also included, as shown (for asymmetric sections, the rules apply to beams that have a ratio of bottom flange area to top flange area of 3:1, but limits for intermediate asymmetries can be interpolated). There is also a third set of rules that are more generous, but these are only applicable to symmetric beams with one 19 mm diameter stud per trough in sheeting spanning perpendicular to the beam. These rules can also only be used when a simplified approach to calculating the moment resistance is used, which simply interpolates between full shear connection and no shear connection (i.e. the bare steel moment resistance). Traditionally a stress-block approach is used, which gives a larger lever arm than the simplified method and hence a larger moment resistance. Reference should be made to EC4 for more details of the simplified rule.

Effective Breadth

At first glance, the changes to the effective breadth (that defines the concrete flange) look fairly significant. In BS 5950, b_e = Span/8 is used for each side of the beam, as long as this is not greater than half the distance between adjacent beams or the distance to the slab edge (so Span/4 in total). In the Eurocodes, the effective breadth varies along the beam, as shown in Figure 5, where b_{e1} = b_{e2} = Span/8, b_1 and b_2 are half the distance from the centre beam to the adjacent beams, β = ¾ and b_0 is the transverse spacing of the studs (if relevant). For the vast majority of beams, the first and

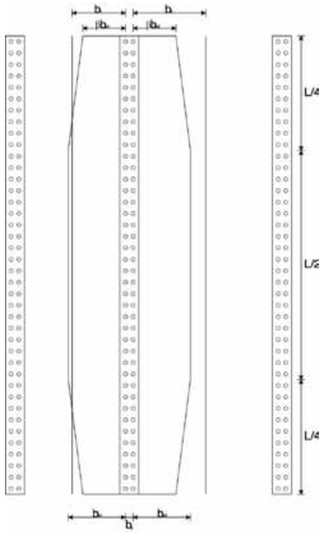

Figure 5: Effective breadth of the concrete flange for a simply-supported beam

last quarter of the span will not be critical, and so only the midspan moment resistance will be relevant, where the effective breadth is the same as the BS with the addition of the transverse spacing of the studs. For serviceability conditions, where the variable effective breadth may be of more relevance, the Standard allows the design to assume that the effective breadth at midspan applies across the entire span, drastically simplifying the calculation. In essence, although it looks different, it is practically exactly the same.

Vertical Shear

As in BS 5950, EC4 relies on the steel section to provide the vertical shear resistance, with no contribution from the concrete. As this is only a property of the steel, the designer is referred to Eurocode 3 to determine the shear area. The shear areas used in the BS and EC are different, as shown in Figure 6, and for common UB sections are approximately 6% larger when using the EC4 approach.

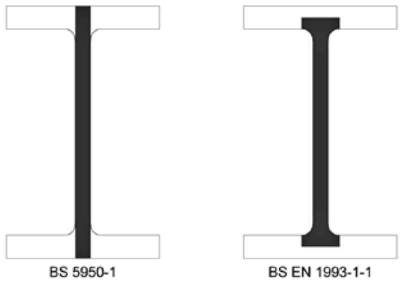

Figure 6: Shear area

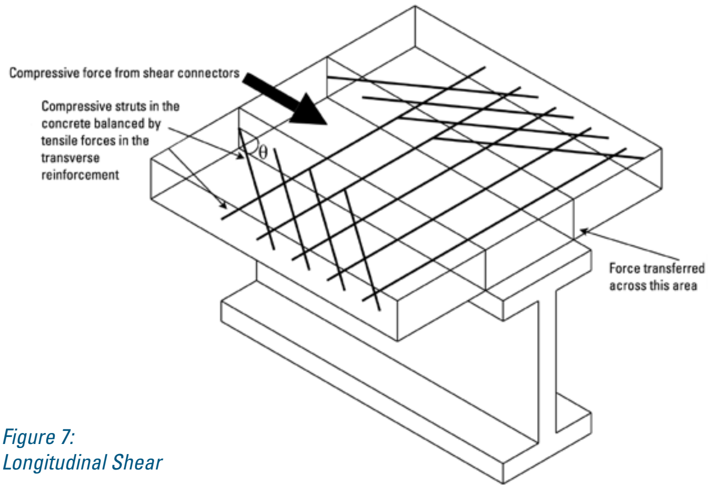

Figure 7: Longitudinal Shear

Longitudinal Shear Resistance

The longitudinal shear resistance of the concrete flange (effectively determining the requirements for transverse reinforcement) is calculated according to the methodology in Eurocode 2, but EC4 also allows for the contribution from the decking to be included if the decking is transverse to and continuous across the beam. In practice, the transverse reinforcement will have to be designed without including the decking contribution as there will always be a number of beams in a structure where one decking sheet finishes and another starts.

The model for longitudinal shear assumes that the force from the shear connectors is spread into the remainder of the slab by angled compression struts in the concrete (shown as dashed lines in Figure 7). To balance the transverse component of these compressive forces, and avoid cracking in the concrete, steel is provided perpendicular to the beam, as shown in Figure 7. The assumed angle of the compressive struts relative to the steel beam can be taken anywhere within the range 26.5° to 45°, with the lower angles giving less steel reinforcement, but higher forces in the concrete. It is therefore important to check not just the tensile resistance of the reinforcement, but also the crushing resistance of the concrete flange.

Detailing

Among the various differences in the detailing rules is one that demands that the 'bottom layer' of mesh reinforcement is positioned at least 30 mm below the head, a rule that appears to have been developed from consideration of the performance of studs in solid slabs. In common 60 mm deep decks, there is a flange stiffener on top taking the overall height closer to 70 mm, meaning that this detailing rule cannot be achieved for typical 19 mm diameter by 95 mm as welded height studs. However, recent tests have shown that positioning the mesh on top of the deck provides sufficient strength and ductility of the connectors.

Further Information

In due course, SCI will be publishing design guides covering the use of EC4 for both traditional composite design and slimfloor design. There will also be an update of SCI/MCRMA P300, covering the design of composite floor slabs using profiled steel sheeting to EC4 and best practice guidelines for their use. SCI courses covering design to EC4 are also scheduled for early in 2009.

References

[1] BS EN 1994-1-1: Eurocode 4: Design of composite steel and concrete structures. General rules and rules for buildings

[2] BS EN 1991 (various parts): Eurocode 1: Actions on Structures

[3] BS EN 1992-1-1: Eurocode 2: Design of concrete structures. General rules and rules for buildings

[4] BS EN 1993-1-1: Eurocode 3: Design of steel structures. General rules and rules for buildings

[5] BS EN 1993-1-3: Supplementary rules for cold-formed thin gauge members and sheeting

[6] BS EN 1994-1-2: Structural fire design

New and Revised Codes & Standards

(from BSI Updates August 2008)

BS EN PUBLICATIONS

The following are British Standard implementations of the English language versions of European Standards (ENs). BSI has an obligation to publish all ENs and to withdraw any conflicting British Standards or parts of British Standard. This has led to a series of standards, BS ENs using the EN number.

Note: *The date referenced in the identifier is the date of the European standard.*

BS EN ISO 636:2008
Welding consumables. Rods, wires and deposits for tungsten inert gas welding of non-alloy and fine-grain steels. Classification
Supersedes BS EN 1668:1997

BS EN ISO 13918:2008
Welding. Studs and ceramic ferrules for arc stud welding
Supersedes BS EN ISO 13918:1998

BS EN ISO 14341:2008
Welding consumables. Wire electrodes and deposits for gas shielded metal arc welding of non alloy and fine grain steels. Classification
Supersedes BS EN 440:1995

BS EN ISO 17632:2008
Welding consumables. Tubular cored electrodes for gas shielded and non-gas shielded metal arc welding of non-alloy and fine grain steels. Classification
Supersedes BS EN 758:1997

BRITISH STANDARDS PROPOSED FOR CONFIRMATION

BS 8100:-
Lattice towers and masts

BS 8100-2:1986
Guide to the background and use of Part 1 'Code of practice for loading'

BS 8100-3:1999
Code of practice for strength assessment of members of lattice towers and masts

BS 8100-4:1995
Code of practice for loading of guyed masts

BRITISH STANDARDS REVIEWED AND CONFIRMED

BS EN 10056:-
Specification for structural steel equal and unequal angles

BS EN 10056-1:1999
Dimensions

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT – NATIONAL BRITISH STANDARDS

08/30128156 DC
NA to BS EN 1993-5
UK National Annex to Eurocode 3. Design of steel structures. Part 5. Piling

08/30145245 DC
NA to BS EN 1990 AMD1
UK National Annex to Eurocode 0. Basis of structural design


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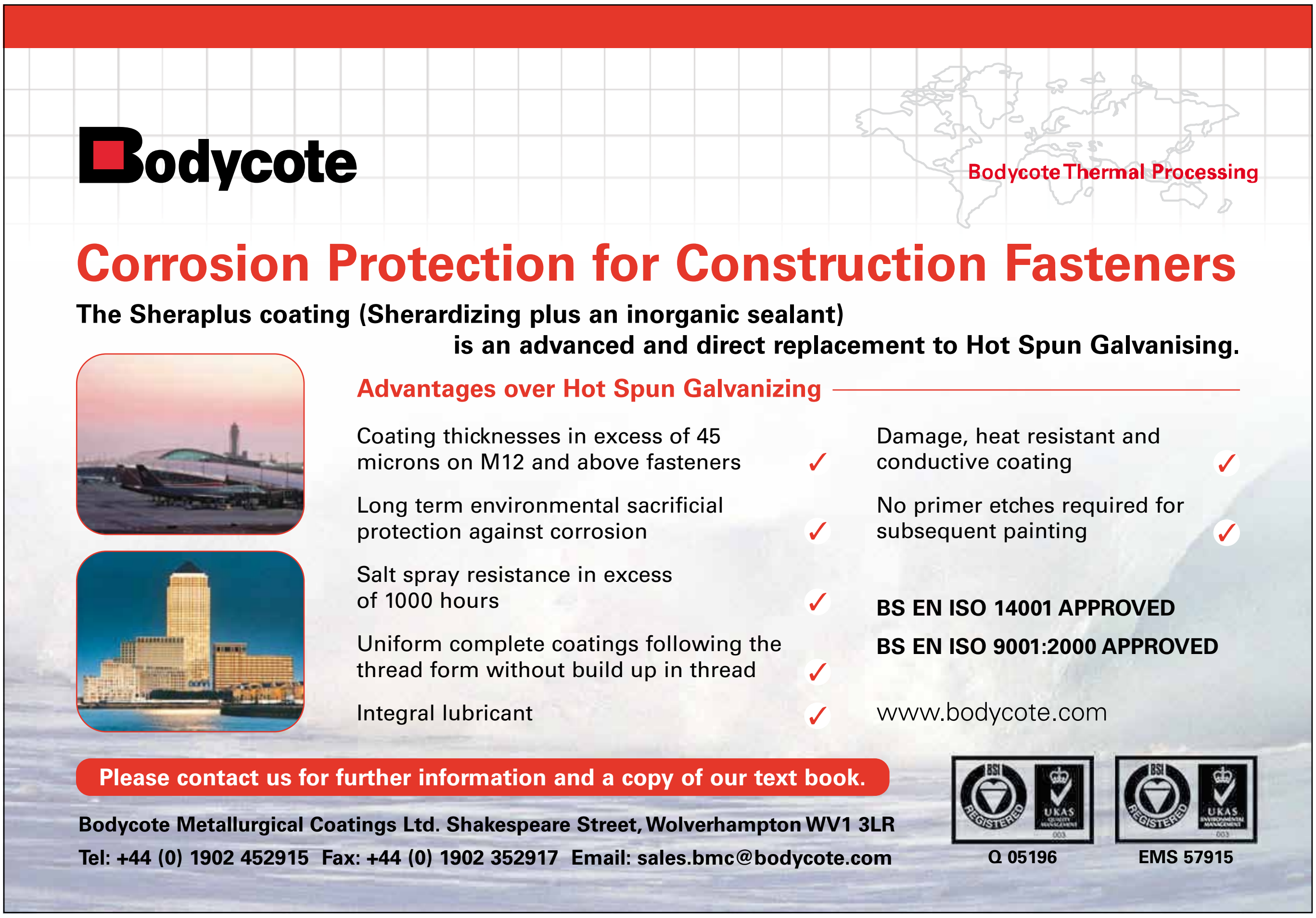
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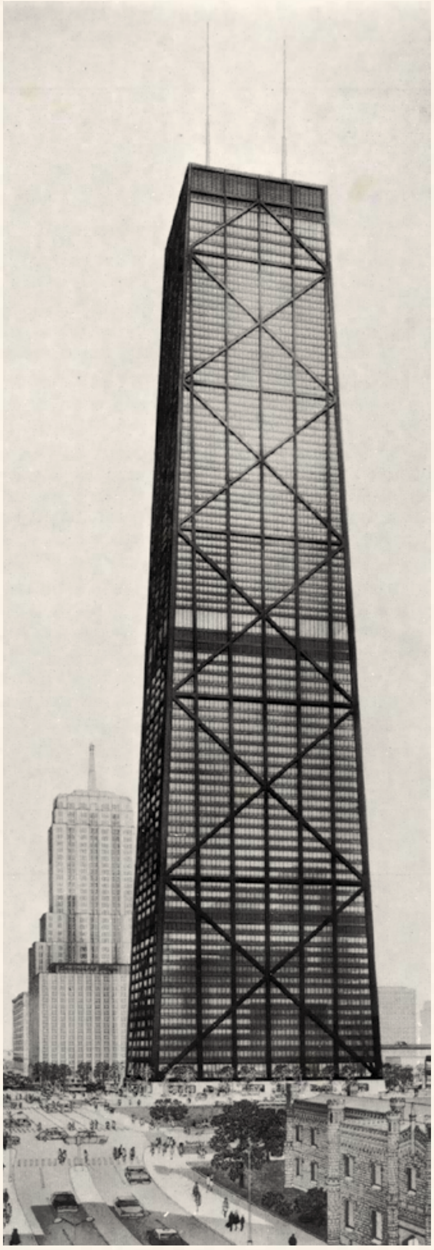

The world's tallest residential-office building begins to climb

The John Hancock Centre in Chicago has to climb to a height of 1,107ft above ground level before it is complete and stands, a giant on a two acre site – see left for a lilliputian's conception of its stature. Salisbury Cathedral spire soars to 404ft and that used to be considered tall!

This journal is vitally interested in the architectural structure about which the following information has been released:

Shape

A tower tapering on all four sides, from 50,000 sq ft at the base to 16,000 sq ft at the summit.

Exterior

The exterior appearance will feature a structural steel frame clad in black and bronze aluminium and bronze-tinted glare reducing glass.

Structure

The structure will be an integral part of the exterior, with diagonals providing stability and strength.

The Centre will afford the most economic space in steel construction: in effect it will be a bridge type structure consisting of a trussed box. The twofold use of the building for public and residential needs will create an architectural landmark, alive an in use 24 hours a day.

Steelwork facts.

Tonnage – 42,000 tons: site connections (a) Weld metal 165,000 lb total: (b) Bolting – 105,000 high strength bolts: height of structural frame, 1,125 ft from top of base plates to top of roof: taper - for each 100ft of height the sides taper in 5 ft, the short sides 3 ft.

Erection – basement to 6th floor – crawler crane: 6th floor to 76th floor – 4 stiffleg derrick creepers: 76th floor to roof – 2 stiffleg derrick creepers.

Scheduled time to erect structural steelwork – 16 months.

Base plates - 12 in thick – 7 ft 10 in by 7 ft 10 in. weight - 15 ton max: exterior plates set out of level (perpendicular to column): 2-in dia. anchor bolts. Maximum Creeper lift - 38 tons.

Column tiers extend for 2, 3, and 4 floors: 15 tons of erection bracing are required at each working location. Each creeper receives steel at ground level and hoists its own steel, the receiving areas decreasing as Creepers ascend the building.

Creeper connection to permanent structure – 2-in thick hitch plates are welded to the outside face of columns, the welding of column plates being extensively tested. The creeper support platform is connected to column plates by using two 41/2 and two 5-in pins.

Exterior framing weights – (a) horizontal ties – max weight 1,735 lb per ft; (b) diagonals – max weight 1,779 lb per ft; (c) columns – max weight 2,859 lb per ft; (d) gusset plate complex at building corners have max weight of 33 tons. Crawler cranes will erect creepers complete.

Lifting with derrick creepers, normally a bridge building technique, was decided upon because all the walls of the centre taper inwards.

Orthodox cranes atop the rising building would have required enormously long booms to reach out beyond the slope of the structure and pick up their loads of steel from the ground.

Each creeper consists of a support platform, a tower and a stiffleg derrick with a 105-ft boom. The rig is 110 ft tall, not counting the boom. The entire unit fits to the side of the building, fastened securely in place with high strength connecting pins (see bottom left).

The creepers began their work after they were installed at the 6th floor level (ground cranes handled steel up to that height). Their booms are long enough to permit erection of three floors of steel before the next three storey upward 'jump' is made.

Powerful electric hoists pull the cranes up to each new position. A system of guide beams and rollers ensures smooth travelling.

The time needed to hoist a fresh load of steel from the ground to the topmost construction level will increase to a maximum of about 10 minutes when the job nears completion.

Creepers climbing up the east and west sides of the Centre will be hoisted 31 times. Those on the north and south faces will be raised 21 times. At the 75th floor the north and south cranes will be removed. The east and West creepers will complete the job after they have been equipped with longer 120-ft booms.

The heaviest steel members in the structure are the four corner columns which reach from the basement to the second floor. Only 39ft long, they weigh 100 tons each. They were erected by crawler cranes.

Architects – Skidmore, Owings and Merrill.

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- Any degree of asymmetry
- Elongated openings for services

CASE STUDY

Ormeau Road, Belfast

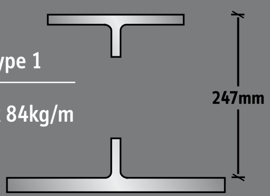
This multi-storey residential development used 7 different USFB sizes ranging from 84kg/m to 184kg/m. The weight of each beam was optimised for the different spans and loading conditions. The USFBs carried an in-situ slab with a deep metal deck. The two USFBs described here were the lightest (Type 1) and heaviest (Type 2).

Engineer: **Albert Fry Associates**
Steelwork Contractor: **Gregg & Patterson**

USFB Ormeau Type 1

262 x 203/305 x 84kg/m

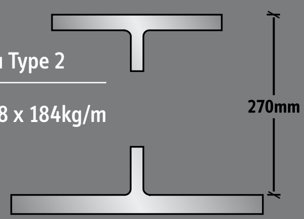
Span 5.5m



USFB Ormeau Type 2

297 x 254/368 x 184kg/m

Span 7m



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AD 325
Curtailment of transverse bar reinforcement in composite beams with steel decking

The purpose of this AD is to provide guidance on the curtailment of transverse bar reinforcement in slabs on composite beams with steel decking, designed to BS 5950-3.1. The transverse reinforcement is provided to transfer the longitudinal shear force from the steel beam, via the shear connectors, out into the effective breadth of the concrete slab. Transverse bar reinforcement is often necessary because the concrete slab and mesh alone are unable to sustain the longitudinal shear force. The question then arises as to how far the transverse bar reinforcement needs to extend into the slab.

Internal beams

The longitudinal shear force in the concrete flange of a composite beam with decking spanning transversely to the beam is shown diagrammatically in Figure 1, where the maximum possible force applied at the position of the shear connector is the resistance of the connector divided by its spacing. Where there is only one connector per trough in the decking, the maximum possible force applied to each side is half the connector resistance divided by its spacing. The force in the slab reduces linearly away from the connectors to zero at limit of the effective breadth, where no further transfer of force to the slab is required. Two approaches can be used to determine the required length of bar, the simplified method and the rigorous method.

Simplified method

For transverse reinforcement in a composite beam with steel decking, a simple, conservative approach is to calculate the transverse reinforcement area required at the plane of the shear connectors using BS 5950-3.1, deduct the area of the mesh and select suitable bar reinforcement. Then specify an anchorage distance that is the greater of the length 40d (50d for LWC) beyond the critical plane and the length to achieve 12d beyond the effective breadth of the concrete, as shown in Figure 1. Note that the mesh must be fully anchored to be included in the calculation.

For a composite beam with decking spanning perpendicular to the longitudinal axis of the beam, the critical plane is adjacent to the steel flange (as shown in Figure 1), but for decking spanning parallel to the beam the critical plane is normally in the nearest crest in the decking to the line of the shear connectors, as shown in Figure 2. It is recommended that, for simplicity, the contribution of the decking is ignored in the calculation of the longitudinal shear resistance when the decking is parallel to the beam.

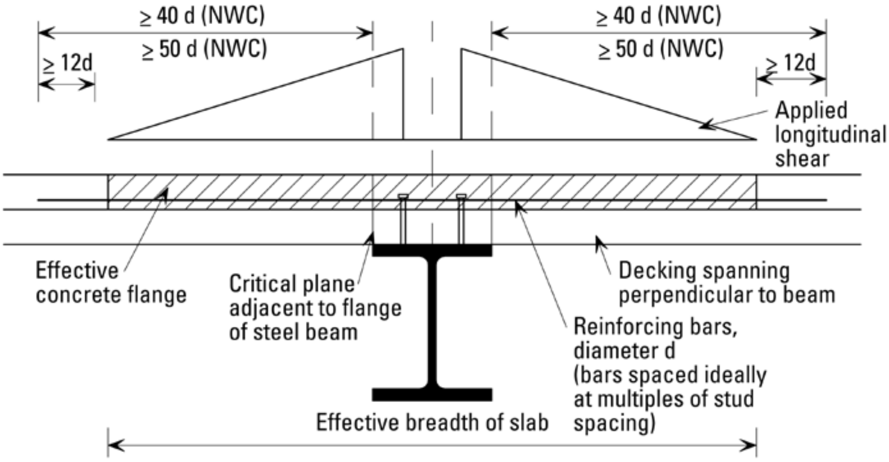

Figure 1: Simplified method

Rigorous method

A more rigorous approach is to plot the applied shear flow diagram across the effective breadth, as shown in Figure 3, calculate the applied longitudinal shear force at the critical plane (which will be less than the peak value) and, deducting the mesh area, determine the required area of bar reinforcement and select a suitable bar size. Then calculate the longitudinal shear resistance of the concrete slab (including the mesh) and find the position where the longitudinal shear force can just be resisted by the slab and the mesh alone. The transverse bar reinforcement should then extend to either 12d beyond this position or to 40d (50d for LWC) from the critical shear plane, whichever is the greater, as shown in Figure 3.

General guidance

When the effective breadth either side of the centre-line of the beam is unequal, the curtailment of the transverse bars should be based on the requirements for the larger side to ensure that both sides are properly anchored. See below for specific advice for edge beams.

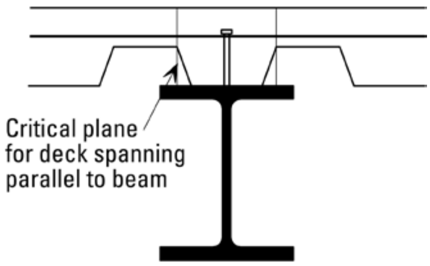

Figure 2: Critical plane for deck spanning parallel to beam

It is recognised that mesh already provided in the slab for fire resistance or to control cracking may already be under tension from hogging bending of the slab across the beam, but it is considered reasonable to include its full capacity when calculating the longitudinal shear

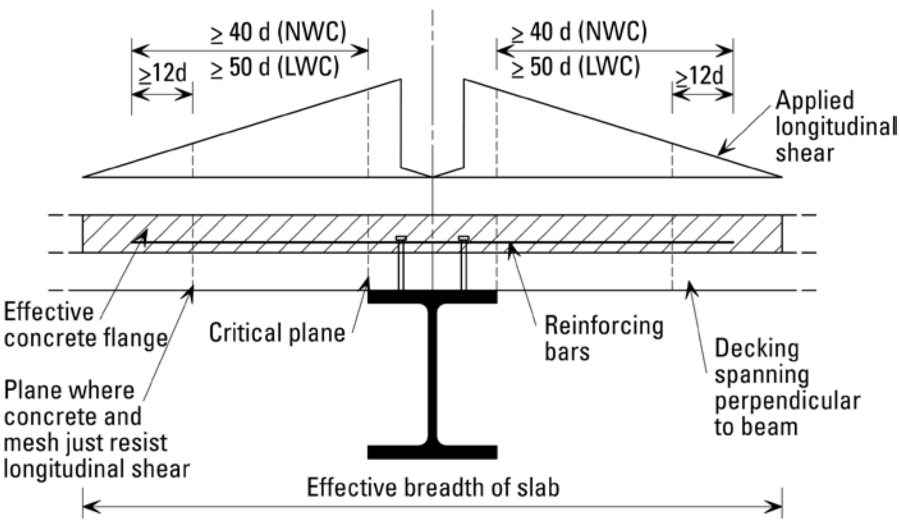

Figure 3: Rigorous method

resistance because the additional compression induced in the concrete will be beneficial to its shear resistance. It should also be noted that the mathematical model for the longitudinal shear resistance in BS 5950-3.1 relies on the presence of some reinforcement, but this is always present, as it is necessary for the design of the slab.

It is recommended that transverse reinforcing bars should be sized on the basis of placement at multiples of the spacing of the shear connectors, ideally (if practical) at one per stud spacing to make inspection on site easier, and to provide a more even longitudinal shear resistance down the length of the beam.

Edge beams

There are special requirements for the diameter and detailing of transverse reinforcement in edge beams set out in BS 5950-3, clause 5.6.5. U-bars are required to prevent the concrete at the edge of the slab from bursting away (longitudinal splitting), and a minimum diameter of bar of half the stud connector diameter is necessary. Although no minimum anchorage requirement is given in the code to prevent bursting, it would be appropriate to provide a minimum anchorage of 40d (50d for LWC) from the centre-line of the studs for both legs of the U-bar. The area of transverse reinforcement required for the longitudinal shear resistance should still be calculated, based on the portion of effective breadth, and compared to the minimum requirement. Note that no mesh should be taken into account, as it is unlikely to be fully anchored.

Careful thought needs to be given when designing edge beams as composite members, as the detailing requirements of the U-bar reinforcement and the minimum edge distance from the stud connector to the outer surface of the concrete (6 times the stud diameter) can be critical.

Contact: Jim Rackham
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AD 326
Revision of BS 5400-3 LTB rules

Following further consideration of the rules related to lateral torsion buckling of beams with flexible torsional restraints, Working Group 3 of the BSI B/525/10 sub-committee has agreed some changes to BS 5400-3. The changes chiefly relate to the use of only a single curve in each of Figure 11a and Figure 11b but a few small editorial changes have also been agreed. To facilitate the implementation of the changes, it has been agreed that they be published in NSC and the changes are given below. It is understood that the Highways Agency are notifying their agents of these changes. It is not expected that BSI will be issuing an amended Standard, in view of its intended withdrawal in March 2010 (at the end of the period of coexistence with the Structural Eurocodes).

9.6.4.1.1 Delete the NOTE.

9.6.4.1.2 Replace the definition of l_w by:
l_w is the assumed half-wavelength of buckling. The value of l_w should generally be taken as the span length *L*. However, to guard against the possibility of a mode of buckling with multiple half-wavelengths within the length *L*, the limiting moment of resistance M_R in accordance with **9.8** should also be checked considering values of l_w corresponding to sub-multiples of the span *L*.

9.6.4.1.2 Replace the parameter *m* by the parameter *n*, in the definitions of θ_R, θ_{R1}, θ_{R2}.

9.6.4.1.2 Replace the parameter *m* and its definition by the parameter *n*, defined as:
n is the number of discrete restraints in the half wavelength of buckling (=1 for a single restraint in the centre of a half wavelength)

9.6.4.1.2 Delete NOTE 2, renumber subsequent NOTES.

9.6.4.1.2 NOTE 5 (renumbered as NOTE 4). In the expression for θ_{R2}, replace the parameter *m* by the parameter *n* and delete the remainder of the sentence after "the spacing of the beams".

9.7.2 In the final sentence, replace "equal to l_e/r_{yc}" by "equal to $\eta l_e/r_{yc}$"

In NOTE 3 in Table 9, replace the expression for *v* by:

$$v = \left[\left\{4i(1-i) + 0.05\lambda_F^{\,2} + \psi_i^2\right\}^{0.5} + \psi_i\right]^{-0.5}$$

9.8 Delete the definitions of l_w, l_e and *L*.

9.8 Replace Figures 11a) and 11b) by those given below (See expressions for curves in Annex G.8)

9.12.2 In the definition of σ_{fc} replace "strength" by "stress"

Annex G.8 In the definition of η, omit the term l_w/l_e in the expressions for both Figure 11a) and Figure 11b). Delete the definitions of l_w and l_e.

Contact: David Iles
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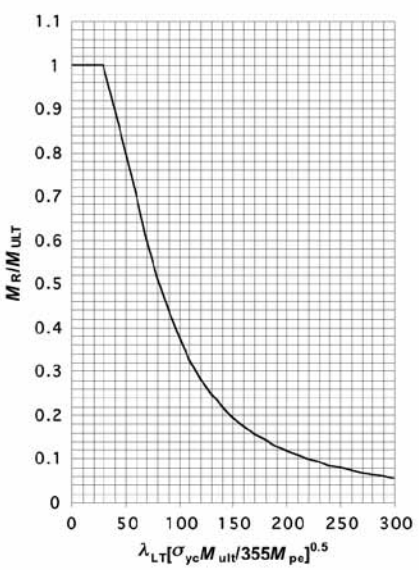
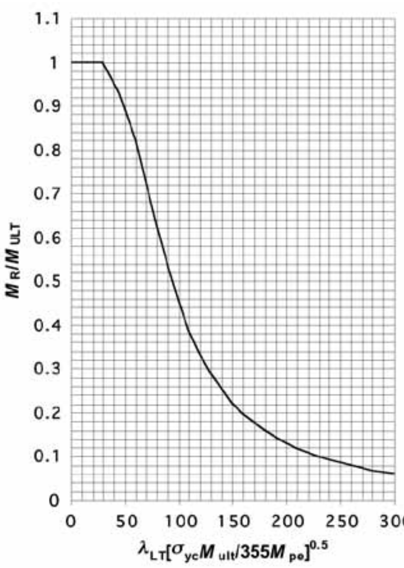


a) Beams fabricated by welding



b) All other sections

Figure 11 Limiting moment of resistance M_R

The British Constructional Steelwork Association Ltd

You can find email and website addresses for all these companies at www.steelconstruction.org

BCSA is the national organisation for the steel construction industry. Details of BCSA membership and services can be obtained from Gillian Mitchell MBE, Deputy Director General, BCSA, 4 Whitehall Court, London SW1A 2ES Tel: 020 7839 8566 Email: gillian.mitchell@steelconstruction.org

KEY

Categories
- **A** All forms of building steelwork
- **B*** Bridgework
- **C** Heavy industrial plant structures
- **D** High rise buildings
- **E** Large span portals
- **F** Medium/small span portals and medium rise buildings
- **H** Large span trusswork
- **J** Major tubular steelwork
- **K** Towers
- **L** Architectural metalwork
- **M** Frames for machinery, supports for conveyors, ladders and catwalks
- **N** Grandstands and stadia
- **S** Small fabrications

Quality Assurance Certification
- **Q1** Steel Construction Certification Scheme Ltd
- **Q2** BSI
- **Q3** Lloyd's
- **Q4** Other

Classification Contract Value
- **10** Up to £40,000
- **9** Up to £100,000
- **8** Up to £200,000
- **7** Up to £400,000
- **6** Up to £800,000
- **5** Up to £1,400,000
- **4** Up to £2,000,000
- **3** Up to £3,000,000
- **2** Up to £4,000,000
- **1** Up to £6,000,000
- **0** Above £6,000,000

Notes
1. Applicants may be registered in one or more categories to undertake the fabrication and the responsibility for any design and erection of the above.
2. Where an asterisk (*) appears against any company's classification number, this indicates that the assets required for this classification are those of the parent company.

* For details of bridgework subcategories contact Gillian Mitchell at the BCSA.

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- **L** Architectural metalwork
- **M** Frames for machinery, supports for conveyors, ladders and catwalks
- **N** Grandstands and stadia
- **S** Small fabrications

Company Name	Telephone	A	C	D	E	F	H	J	K	L	M	N	S	QA	Contract Value (1)
ACL Structures Ltd	01258 456051				●	●	●				●				Up to £2,000,000
AWF Steel Ltd	01236 457960					●				●			●		Up to £100,000
Adey Steel Ltd	01509 556677					●	●	●		●	●				Up to £3,000,000
Advanced Fabrications Poyle Ltd	01753 531116					●	●	●	●	●	●			●	Up to £400,000
Allott Bros & Leigh Ltd	01709 538000				●	●	●	●			●			●	Up to £1,400,000*
Allslade PLC	023 9266 7531				●	●	●			●					Up to £4,000,000
Andrew Mannion Structural Engineers Ltd	00 353 90 6448 300			●	●	●	●	●			●	●		●	Up to £6,000,000
Apex Steel Structures Ltd	01268 660828					●	●			●	●				Up to £800,000
Arromax Structures Ltd	01623 747466		●	●	●	●	●	●	●		●	●			Up to £800,000
Atlas Ward Structures Ltd	01944 710421	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000*
B D Structures Ltd	01942 817770				●	●	●				●				Up to £1,400,000
BHC Ltd	01555 840006		●	●	●	●	●								Above £6,000,000
B & K Steelwork Fabrications Ltd	01773 853400		●		●	●	●	●	●		●			●	Up to £4,000,000*
A C Bacon Engineering Ltd	01953 850611				●	●	●								Up to £1,400,000
Ballykine Structural Engineers Ltd	028 9756 2560				●	●	●	●				●		●	Up to £2,000,000
Barrett Steel Buildings Ltd	01274 266800				●	●	●							●	Up to £6,000,000
Barretts of Apsley Ltd	01525 280136					●				●	●				Up to £3,000,000
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 £2,000,000
Bourne Steel Ltd	01202 746666	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000
Brooksby Engineering	01707 872655					●	●	●	●	●	●				Up to £200,000
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 381188	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000*
Compass Engineering Ltd	01226 298388		●		●	●	●		●						Up to £2,000,000
Conder Stuctures Ltd	01283 545377			●	●	●	●							●	Up to £6,000,000
Leonard Cooper Ltd	0113 270 5441		●			●	●		●		●			●	Up to £800,000
Cronin Buckley Fabrication & Construction Ltd	00 353 21 487 0017				●	●	●				●				Up to £6,000,000
Crown Structural Engineering Ltd	01623 490555				●	●	●		●		●			●	Up to £1,400,000
DGT Steel & Cladding Ltd	01603 308200				●	●	●							●	Up to £6,000,000
Frank H Dale Ltd	01568 612212			●	●	●								●	Up to £6,000,000
Duggan Steel Ltd	00 353 29 10072			●	●	●	●	●			●				Up to £6,000,000
Elland Steel Structures Ltd	01422 380262	●	●	●	●	●	●	●	●	●	●	●		●	Up to £6,000,000
Elsome Structures Ltd	01664 813234					●				●	●				Up to £800,000*
Emmett Fabrications Ltd	01274 597484				●	●	●								Up to £800,000
EvadX Ltd	01745 336413	●	●	●	●	●	●	●	●	●	●	●		●	Up to £3,000,000
Fairfield-Mabey Ltd	01291 623801	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000
Fisher Engineering Ltd	028 6638 8521	●	●	●	●	●	●	●	●	●	●	●		●	Up to £6,000,000
Fox Bros Ltd	00 353 53 942 1677				●	●	●	●			●				Up to £3,000,000
GME Structures Ltd	01939 233023				●	●	●	●		●	●		●		Up to £800,000
Gibbs Engineering Ltd	01278 455253					●	●	●		●	●			●	Up to £800,000
Glentworth Fabrications Ltd	0118 977 2088					●		●	●	●	●	●	●		Up to £800,000
Graham Wood Structural Ltd	01903 755991	●	●	●	●	●	●	●	●	●	●	●			Up to £6,000,000
Grays Engineering (Contracts) Ltd	01375 372411					●		●		●	●				Up to £200,000
D A Green & Sons Ltd	01406 370585	●	●	●	●	●	●	●	●	●	●	●		●	Up to £6,000,000
William Haley Engineering Ltd	01278 760591				●	●			●	●	●			●	Up to £2,000,000
Hambleton Steel Ltd	01748 810598			●	●	●	●	●				●		●	Up to £6,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000
Hills of Shoeburyness Ltd	01702 296321									●	●		●		Up to £800,000
James Bros (Hamworthy) Ltd	01202 673815				●	●	●				●			●	Up to £1,400,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●					●			Up to £6,000,000*
Leach Structural Steelwork Ltd	01995 640133		●		●	●	●	●			●				Up to £1,400,000
Maldon Marine Ltd	01621 859000					●		●	●	●					Up to £1,400,000
Peter Marshall (Fire Escapes) Ltd	0113 307 6730									●	●				Up to £800,000
Mifflin Construction Ltd	01568 613311			●	●	●	●				●				Up to £3,000,000
Milltown Engineering Ltd	00 353 59 972 7119				●	●	●	●							Up to £6,000,000
Newton Fabrications Ltd	01292 269135				●	●				●	●	●	●	●	Up to £2,000,000
Nusteel Structures Ltd	01303 268112						●	●	●	●				●	Up to £2,000,000*
PMS Fabrications Ltd	01228 599090				●	●	●			●			●		Up to £1,400,000
Harry Peers Steelwork Ltd	01204 558500		●		●	●	●	●	●	●	●			●	Up to £4,000,000
Pencro Structural Engineers Ltd	028 9335 2886				●	●	●	●			●			●	Up to £2,000,000
RSL (South West) Ltd	01460 67373				●	●	●				●				Up to £1,400,000
John Reid & Sons (Strucsteel) Ltd	01202 483333	●	●	●	●	●	●	●	●	●	●	●			Up to £6,000,000
Remnant Engineering Ltd	01594 841160					●	●	●		●			●	●	Up to £400,000*
Rippin Ltd	01383 518610				●	●	●	●							Up to £2,000,000
J Robertson & Co Ltd	01255 672855									●	●		●		Up to £200,000
Robinson Construction	01332 574711		●	●	●	●	●							●	Above £6,000,000
Rowecord Engineering Ltd	01633 250511	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000
Rowen Structures Ltd	01773 860086	●	●	●	●	●	●	●	●	●	●	●			Up to £6,000,000
S H Structures Ltd	01977 681931						●	●	●	●					Up to £3,000,000
SIAC Butlers Steel Ltd	00 353 502 23305			●	●	●	●	●			●	●		●	Above £6,000,000
SIAC Tetbury Steel Ltd	01666 502792			●	●	●	●							●	Up to £3,000,000
Selwyn Construction Engineering Ltd	0151 678 0236									●	●		●		Up to £200,000
Severfield-Reeve Structures Ltd	01845 577896	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000
Shipley Fabrications Ltd	01400 231115				●	●	●		●	●	●		●		Up to £200,000
Henry Smith (Constructional Engineers) Ltd	01606 592121		●	●	●	●	●	●							Up to £4,000,000
W & H Steel & Roofing Systems Ltd	00 353 56 444 1855				●	●	●	●							Up to £4,000,000
The AA Group Ltd	01695 50123		●	●	●	●	●				●				Up to £1,400,000
Traditional Structures Ltd	01922 414172			●	●	●	●	●	●		●	●		●	Up to £2,000,000*
Paddy Wall & Suns	00 353 51 420 515				●	●	●	●						●	Up to £6,000,000
Watson Steel Structures Ltd	01204 699999	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000
Westbury Park Engineering Ltd	01373 825500					●		●	●	●	●			●	Above £800,000
WIG Engineering Ltd	01869 320515					●				●					Up to £400,000
H Young Structures Ltd	01953 601881		●		●	●	●	●				●			Up to £800,000

Notes

(′) Contracts which are primarily steel but which may include associated works. The steelwork contract for which a company is pre-qualified for 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.

BRIDGEWORKS SCHEME

Based on evidence from the company's resources and portfolio of experience, the Subcategories that can be awarded are as follows:

FG Footbridges and sign gantries
PT Plate girders [>900mm deep], trusswork [>20m long]
BA Stiffened complex platework in decks, box girders, arch boxes.
CM Cable stayed bridges, suspension bridges, other major structures [>100m]
MB Moving bridges
RF Bridge refurbishment
X Unclassified

Applicants may be registered in more than one sub-category.

Company Name	Telephone	FG	PT	BA	CM	MB	RF	X	Contract Value (1)
Allerton Engineering Ltd	01609 774471	●	●	●	●	●	●		Up to £400,000
Briton Fabricators Ltd	0115 963 2901	●	●	●	●		●		Up to £1,400,000
Cimolai SpA	01223 350876	●	●	●	●	●			Up to £6,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●		Above £6,000,000*
Concrete & Timber Services Ltd	01484 606416	●	●		●	●			Up to £800,000
Fairfield-Mabey Ltd	01291 623801	●	●	●	●	●	●		Above £6,000,000
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*
'N' Class Fabrication Ltd	01733 558989	●	●	●		●	●		Up to £1,400,000 (CVA)
Nusteel Structures Ltd	01303 268112	●	●	●	●		●		Up to £2,000,000*
P C Richardson & Co (Middlesbrough) Ltd	01642 714791	●					●		Up to £6,000,000
Remnant Engineering Ltd	01594 841160	●							Up to £400,000*
Rowecord Engineering Ltd	01633 250511	●	●	●	●	●	●		Above £6,000,000
Taylor & Sons Ltd	029 2034 4556	●	●	●	●	●	●		Up to £1,400,000
Watson Steel Structures Ltd	01204 699999	●	●	●	●	●	●		Above £6,000,000

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(*) 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.

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- Technical Support for Architects
- Bridge Engineering
- Building Interfaces
- Civil Engineering
- Fabrication
- Health & Safety — best practice
- Information Technology
- Fire Engineering
- Light Steel and Modular Construction
- Offshore Hazard
- Codes and Standards
- Composite Construction
- Connections
- Construction Practice
- Corrosion Protection Engineering
- Offshore Structural Design
- Piling and Foundations
- Specialist Analysis
- Stainless Steel
- Steelwork Design
- Sustainability
- Vibration

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Email: s.gentle@steel-sci.com Website: www.steel-sci.com

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