

NEW STEEL CONSTRUCTION

NSC

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Sheffield scores new hotel
Guernsey gains new hospital
Retail leads Cardiff regeneration**

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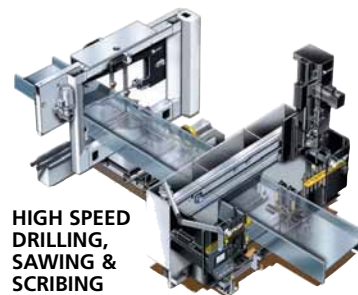
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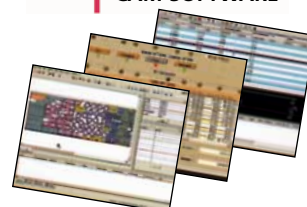


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* Patent pending





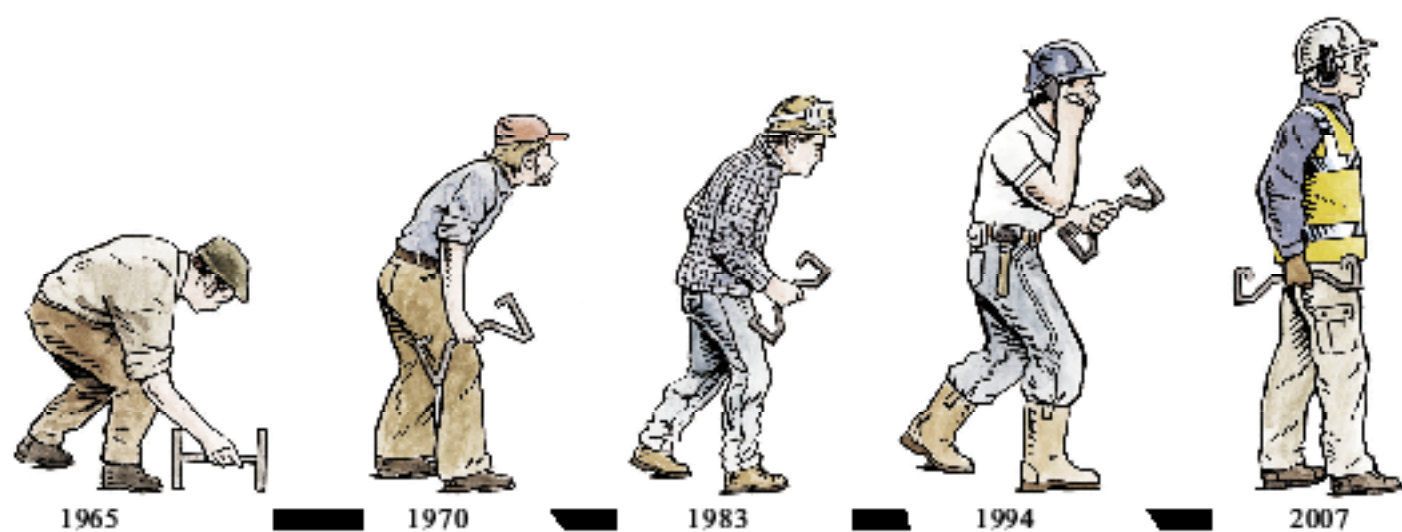
Cover Image
Snow Hill Building One, Birmingham
 Client: Ballymore Properties
 Architect: Fairhursts
 Structural engineer: Curtins Consulting
 Steelwork contractor: Barrett Steel Buildings



- 5** **Editor's comment** 2007 was a successful year for the steel construction industry with expectations even higher for 2008, not just in the UK but worldwide.
- 6** **News** The BCSA confirms that British Standards can continue to be used beyond 2010.
- 12** A BCSA mission to **Australia** discovered that leading antipodean contractors are now keen users of constructional steelwork.
- 14** A hotel is the latest development at **Sheffield United's** historic Bramall Lane ground, where access to the stadium has been kept open throughout construction.
- 16** A design and build steelwork contract has helped speed up the construction programme on a multi-storey **Birmingham** office block.
- 18** The multi-use **St David's 2** development, the largest private financial investment in Wales, will regenerate a large swathe of central Cardiff.
- 20** A new series of articles entitled **The case for steel**, outlining the advantages of using constructional steelwork, begins this month.
- 22** A number of logistical challenges, including getting steel to Guernsey, had to be overcome before work could start on the **Princess Elizabeth Hospital** extension.
- 24** Steelwork has been completed on the first **ProLogis distribution centre** in the South West of England.
- 26** A **cost comparison study** has again confirmed that steel framing solutions are faster and cheaper to build than reinforced concrete alternatives.
- 30** The **Buildoffsite Registration Scheme** is explained by SCI Deputy Director Bassam Burgan.
- 34** **40 Years Ago** Our look back through the pages of Building with Steel takes in Madison Square Gardens which features America's largest cable suspension roof.
- 36** **Advisory Desk** The latest advice from the SCI - AD 317 - explains the use of integral crossheads in skew highway bridges.
- 38** **Publications** and **Codes and Standards**
- 40** **BCSA members**
- 42** **SCI members**

MULTIBEAM

PURILIN AND RAIL SYSTEM





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The British
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Steelwork
Association Ltd



Steel winning new friends worldwide

Newspaper headlines worldwide were being dominated at the end of 2007 with alarming phrases like 'credit crunch' and 'credit meltdown', giving rise to all sorts of gloomy prognostications about the prospects for the future. Should we be worried?

Global economic events are at the best of times out of the control of even the strongest governments, so individual countries let alone industries and the companies within them can hope to do little to influence events. Companies can at least set their own houses in order and this is what steelwork contractors have focussed on in the years since the last major downturn in industry workloads in the early 1990's. Steelwork contractors are on generally far sounder commercial footings than some were in the early 1990's. As bad as today's outlook might be when City views are tapped, nobody is forecasting anything on the scale of that downturn.

Clients can be assured that in 2008 they will continue to have access to competitive quotes from a wide range of well founded contractors when they opt for steel. There has been a notable amount of consolidation in the industry recently. Industry leader Severfield-Rowen has bought a key player in Northern Ireland and Dublin based SIAC has been on the acquisitions trail on the UK mainland. None of this has been fire sales of failing companies; on the contrary, all those acquired have been attractive to their purchasers because of their solid performance and prospects.

BCSA members are starting the year with strong order books and a degree of confidence that the outlook remains strong, if not as promising in one or two areas as it was. Some City or West End developments might be pushed to the backburner but order books are healthy and the economic underpinnings look favourable for most clients.

Steel can be expected to continue to gain ground over competing alternative materials in 2008 as clients increasingly appreciate the full Case for Steel, which we start a new series on in this month's NSC. On that topic, delegates to the recent Australian Steel Convention were delighted to hear from a regional director of no less a player than Multiplex that the company is turning its back on concrete as a framing material after having been convinced of the cost and other benefits of steel. You can read more about that on Page 12. Happy New Year.



Nick Barrett - Editor

British Standards can be used beyond 2010

The BCSA has issued a memo to all members regarding a marketing circular being promoted by the British Standards Institute (BSI), that states four steel standards will be withdrawn in March 2010.

"The circular suggests that British Standards cannot be used after that date and that all designs must be in accordance with the Eurocodes," said Dr David Moore, BCSA Director of Engineering. "Such a view is incorrect."

The BSI is a member of the Committee of European Normalisation (CEN) and as such has an obligation to withdraw national standards that conflict with Eurocodes by the end of March 2010. However, this doesn't mean national standards cannot be used.

The four standards in question are: BS 4076 1989 Specification for steel chimneys; BS 5950 Series structural use of steelwork in building; BS 5400 Series steel, concrete

and composite bridges and BS 8100 Series lattice towers and masts.

Dr Moore explained that in a letter to Nigel Farage MEP dated 15 May 2007, Angela Smith MP (the then Parliamentary Under Secretary of State) said that Approved Document A is a guidance giving acceptable methods of compliance with the Building Regulations. However, the list of documents contained within Part A is not exhaustive and, in effect, any established method

of safety design can be adopted provided it has a proven history for safe design. Therefore, although our existing National Standards will not be referenced beyond 2010, it does not necessarily mean they cannot be used in the short term.

"BSI has a policy of reviewing national standards every five years. Therefore the four standards will be reviewed before 2010, to give them at least another five years of life to 2015," said Dr Moore.

Differing bay heights at new distribution centre



Conder Structures has erected an out of the ordinary distribution centre, containing high and low bays, at Manchester's Trafford Park, the UK's oldest industrial park.

Working on behalf of main contractor Morgan Ashurst, Conder undertook a design and build contract for the 34,444m² structure and erected 1,900t of structural steelwork.

The building consists of two sections, one comprising high bays which are 20m to underside of haunch, and another sector with lower bays which rise to 13m to underside of haunch.

The high bay area measures 175.2m long x 92.4m wide and has 24 bays. This high bay section will incorporate an automated warehouse handling system for accessing a pallet racked store.

The connected low bay area of the warehouse covers an area of 14,950m² and includes a mezzanine floor of 6,410m².

Within the structure there is an integrated two-storey 1,854m² office building with a reception, staff rest rooms, offices, and packing and despatch area.

Ravenscraig regeneration gathers pace

The site of the former steelworks at Ravenscraig in North Lanarkshire will be the UK's first new town in more than 50 years and home to more than 10,000 people.

Covering an area of 450 hectares, the project will require a number of significant construction projects including retail, leisure, residential, educational and transport schemes.

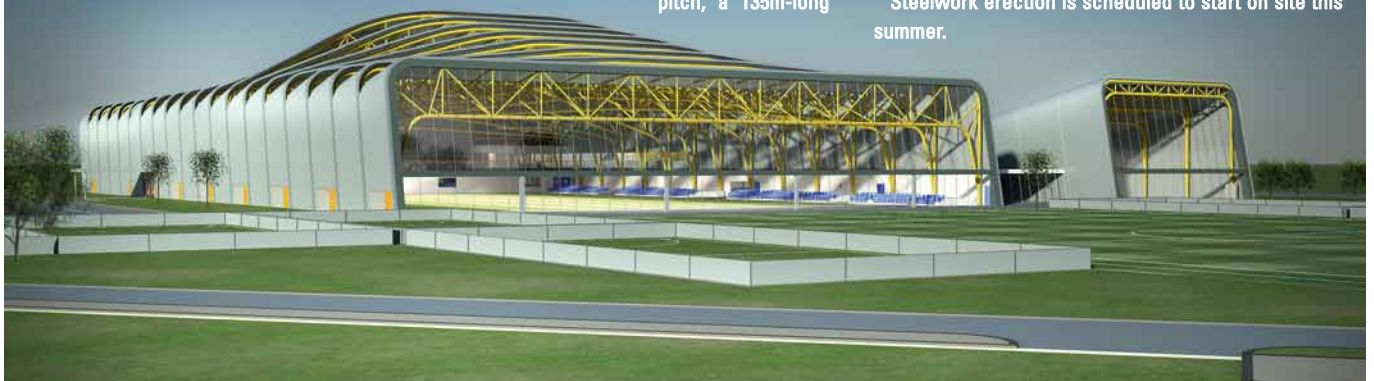
One of the first structures to get the green light is a new 220,000m² Regional Sports Facility which will feature a full-size indoor synthetic football pitch, a 135m-long

six-lane athletics track, a nine-court indoor sports hall and six floodlit outdoor five-a-side football pitches.

Project architect HOK Sport, says it has incorporated the site's historical steel heritage into the Sports Facility's steel design and metal bands, reminiscent of rolled metal sheets, will wrap around the structure.

The facility will feature some long spans, especially in the building housing the indoor football pitch. This part of the overall structure will be 105m long x 22m high and will feature clear spans in excess of 70m.

Steelwork erection is scheduled to start on site this summer.



Olympic authority unveils designs for 2012 stadium

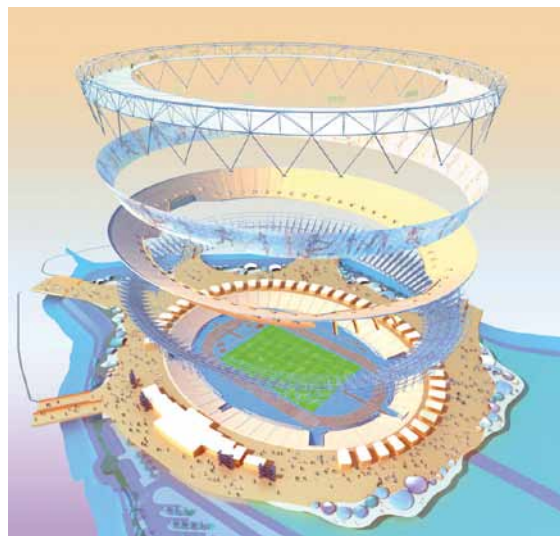
The design for the eagerly awaited London Olympic Stadium has been made public by the Olympic Delivery Authority (ODA).

The 80,000 seat, predominantly steel, stadium will include 55,000 demountable seats, a cable-stayed roof sheltering two thirds of the crowd and a fabric curtain wall, which will wrap around the structure to provide extra protection from the elements.

After the Games, the Stadium's upper tier and roof will be dismantled, with the lower tier remaining as a 25,000-seat

home for athletics and other sporting and community uses. The steel roof structure will be scaled down and then re-erected above the smaller stadium, while all the steel and materials used for the demountable structure will be recycled or reused.

The design and build team for the project includes Sir Robert McAlpine, architect HOK Sport, structural engineer Buro Happold and Watson Steel Structures, which will be supplying and erecting approximately 12,000t of structural steel.



Big lifts needed for seaside redevelopment



Main contractor Allenbuild has lifted two steel transfer trusses, with a total weight of 167t, as part of the £14.5M redevelopment of the Floral Hall Gardens site in Southport.

The large steel sections, fabricated by James Killelea, will form the roof structure for a column-free conference centre, while above they will support the frame of a six-storey hotel.

The largest truss measured 29m x 4m, weighed 94t, comprised four

main booms and 22 internal members, and required 3,770 bolts. The second, weighed 73t and consisted of more than 70 individual steel members.

Due to be completed by the end of this year, the Floral Hall development will transform the seafront at Southport. The project includes a casino, conference facilities, a four-star hotel, a new public plaza, as well as new bars and restaurants.

SCI pays tribute to retiring director



Left: The head table from left to right, Dr Graham Owens, former SCI Director; Graham Watts, Construction Industry Council; Professor David Nethercott, SCI Deputy Chairman; Garry Richardson, Guest Speaker; Martin Manning, SCI Chairman; Andrew Page, Managing Director Corus Construction and Industrial; Professor Patrick Dowling; Dr Terry Goodwin, Corus Strip and Graham Couchman, SCI Director. Above right: Dr Owens (left) receives his Life Member certificate from Professor Dowling.



The Steel Construction Institute's Director Dr Graham Owens marked his resignation after a 21-year career at the Institute, at the annual dinner held at the Landmark London Hotel in November. Guests heard Professor Patrick Dowling pay tribute to Dr Owens' great contribution to the success of constructional steelwork

in the UK while at the SCI and in his earlier academic career.

Professor Dowling said he was a gifted experimentalist who always produced even more data from his researches than had been hoped for. He achieved the rare distinction of being elected to the Royal Academy of Engineering on first application.

Earlier contributions to engineering included producing scale models of the Thames Barrier, a cutaway section of which is still on display. 'I am delighted and proud of all of his achievements,' said Professor Dowling.

Dr Owens, who has been made the fifth Life Member of the SCI,

said it had been a privilege to be involved with the SCI. 'It has been a challenging experience and we have been incredibly successful,' he said. 'We managed to make a real difference to the quality of steel design in construction.' Dr Owens thanked all those who had put their faith in the SCI, especially Corus.

Construction News

8 November 2007

Steeling ahead on a massive hospital build

"There were quite a few reasons why we chose steel in the end. The speed of construction was the most obvious, it's far quicker than concrete to erect, and by fabricating off-site it meant work on the frame could begin while we were still carrying out site preparation works," says Mike Harris, Balfour Beatty's PFI Director.

Construction News

15 November 2007

No time like the present for steel to reinforce its position

Hospital projects, multi-storey residential schemes and low-rise developments all use steel as a framing method as a matter of course, with its speed of construction a favourite feature for project managers.

Construction News

15 November 2007

Steel provides a Grand solution

"The building (Grand Canal Quay Hotel) was originally designed as a concrete trapezoidal bridge structure," explains Denis McNelis, Engineering Director of AMSE. "The design was too complex for a concrete structure."

The Structural Engineer

6 November 2007

A new design for steel bridge decks

The design of steel orthotropic decks has traditionally reflected the constraints of cost and fabrication rather than the aspirations of designers. Recent advances in materials joining technology provide an opportunity to overcome these limitations.

Building

9 November 2007

Olympic authority unveils its designs for 2012 stadium

After the Games the stadium's upper tier and roof will be dismantled, with the lower tier remaining for legacy use. Steel and materials used for the temporary structure will be recycled.

New guide will aid project efficiency

A new BCSA initiative, endorsed by the Health & Safety Executive, has resulted in the launch of 'Allocation of Design Responsibilities in Constructional Steelwork.'

Also known as the Orange Book, the new publication has been developed to address the problem of information flow on construction projects.

Marion Rich, BCSA Director of Legal and Contractual Affairs, said: "For a long time there have been problems with clients not getting timely information which then results in time consuming and expensive variations to a job. This document has

been launched to address this issue for steel construction projects."

The guidance has been produced in cooperation with the Association of Consultant Architects, Association for Consultancy and Engineering, Construction Confederation, Institution of Structural Engineers, SCI, and Griffiths and Armour, representing the insurers.

The guide is for all concerned with steel construction projects, from client through the supply chain to steelwork contractor.

The heart of the document comprises a set of checklists detailing vital information for the

various activities on a steel construction project.

The new guidance adds an extra level of detail to the well established National Structural Steelwork Specification (Black Book). It is also designed to fit in with other industry work schedules.

Geoff Badge, Managing Director of Emmett Fabrications, and Chairman of the Steering Group that masterminded the guidance, said: "We now have a document that will focus the contract team into providing accurate and timely information for the ultimate benefit of all concerned."

Long loads leave Lincolnshire

A total of eight 36.5m-long x 4m wide fabricated trusses have left steelwork contractor D.A. Green & Sons' yard, destined for a new engineering workshop project in Northamptonshire.

The steel trusses are said to be some of the longest loads ever seen in the company's home county of Lincolnshire, and each unit required a police escort.

"The trusses are just low enough to pass under motorway bridges," said Sean Clarke, Contracts Manager for D.A. Green. "We did however have to leave the highest purlin cleats off to get the clearance."

The trusses will form the clear span roof for the new workshop,

and Mr Clarke said the steelwork was transported in completed units in order to cut down on site welding.

The steel framed workshop will require D.A. Green to erect approximately 450t of structural steelwork.



Steel shapes speculative office development



Billington Structures has fabricated, supplied and erected 1,161t of structural steel for a multi-storey speculative scheme for Scarborough Developments in Sheffield city centre.

Known as the Digital Campus Office Development, the scheme is one of many projects currently underway in the Ponds Forge area of the city.

The four-level structure includes basement car parking, 16.5m clear spans on all office floors, feature canopies and cantilevers, and steel braced cores.

During an 18 week programme Billington also supplied and installed metal decking throughout the project and pre-cast concrete stairs.

Steel wins five categories at prestigious awards

A number of high profile UK steel projects received accolades at the recent Institution of Structural Engineers' (IStructE) 40th anniversary Structural Awards.

The Savill Building in Windsor Great Park picked up the 2007 Supreme Award for Structural Engineering Excellence. Working with architects Glenn Howells, consulting engineers Buro Happold and Haskins Robinson Waters, SH Structures supplied the steelwork for both the timber gridshell roof and the perimeter glazed facades.

The project was also winner in the Arts, Leisure and Entertainment Structure category.

The winner in the Sports Structures category was Arsenal FC's Emirates Stadium (see NSC April 2005) which the judges said combined a complex steel geometric design to form a fully-functioning large capacity multi-use project. Structural engineer for the project was Buro Happold and steelwork contractor

was Watson Steel Structures.

Norfolk based steelwork contractor A.C. Bacon Engineering erected 280t of steel for the Adnams Distribution Centre (see NSC June 2006) which won the David Alsop Sustainability Award. This project consists of a steel frame, which supports large glulam beams clad with innovative hemp blocks. The design reduces energy use and the building has been described as the greenest warehouse in the UK.

In the Transportation Structures category the Sheppey Crossing (see NSC July/August 2007) was the winning entry. The judges were impressed with the structure's unobtrusive, yet elegant design. They said its grand statement is reinforced by elegant proportioning and delicate detailing.

Steelwork contractor for the project was Fairfield-Mabey, while Cass Hayward LLP and Capita Symonds formed the structural design team.



Crown Estate - Warwick Swain



Sabine Aerial Photography



Top to bottom: The Savill Building, Emirates Stadium, Adnams Distribution Centre and the Sheppey Crossing.

UK debut for new processing machine

The UK's first FICEP Tipo C25 machine has been installed at the Severfield-Rowen steel fabricating facility in Thirsk, North Yorkshire.

The Tipo C25 is said to be the first thin sheet material processing machine that also combines milling, tapping, countersinking and machining operations.

Severfield-Rowen's new purchase – the company's eighteenth FICEP unit – replaces three older units and will process material from 6mm to 20mm thicknesses as well as improving efficiency in the fittings area.

The Tipo C25 has been specifically developed to process sheet materials from 1.00mm to 25mm, with the facility to punch, mill, drill, countersink, tap, ream, mark and high definition plasma cut, all in one processing cycle.

A high-speed punching facility of up 180 hits per minute

can be enhanced with a 14 position tool changer which has a capacity to utilise punching diameters up to 80mm. The drilling unit can also perform milling, tapping, countersinking and machining operations.

Other notable features of the new machine include its monolithic construction, which shortens the installation time.



Light frame checks in at safari lodge

Metsec Framing Division has designed and installed the framing structure for Chessington World of Adventures' new safari lodge.

Working with Speymill Contracts, Metsec installed a free-standing 5,540m² MetFRAME system which provides a structure for two three-storey wing blocks, which contain a total of 150 bedrooms.

Speymill said the decision to use

a MetFRAME structure was based on three main criteria. It is easily applied to podium developments, it is quick and easy to erect, and the system was able to support a timber roof.

MetFRAME structures use cold rolled lightweight galvanised steel sections to form structural elements of a building frame. The steel elements are designed according

to individual requirements, and produced and assembled into building frame panels off-site. This allows for consistency and reduces construction time.



Kaltenbach's UK Managing Director Manfred Saenger will relinquish his position to Simon Smith, the company's Sales and Marketing Director from 1 January 2008. Mr Smith, said: "My appointment has been planned to ensure continuity for our staff and UK customers, with the added benefit of retaining Manfred's expertise as part of our team."

Metsec has been awarded the ISO 14001 environmental standard accreditation. Stephen Tilsley, Metsec Chief Executive, said: "We have reduced CO₂ emissions by 25%, reduced gas consumption by 37% and reduced electricity consumption by 14%."

Peter Owens, Project Manager for steelwork contractor William Hare, won Lend Lease's Partner of the Year award for 2007. The award recognises those who have made a real and tangible difference to health and safety. Lend Lease said William Hare and Mr Owens have led a number of initiatives, which include the Cellshield Barrier System, the Trailer Unloading System and Mobile Elevating Work Platform Frames.

SH Structures was named 'Structural Specialist of the Year' at the 2007 Building Magazine Specialist Contractors Awards. The event, which was held at the Park Lane Hilton in London, highlights the contribution to the construction industry made by specialist companies in a diverse range of activities.

Sustainable construction – The bigger picture – distributed with this issue of NSC is also downloadable free of charge from www.corusconstruction.com

CSC's 3D+ AutoCAD-based modelling system for automating GA drawing production and integration with the company's design software has been upgraded. The new 3D+ V8 has a number of new features, such as enhancements to drawings, modelling and Westok members.

New design and detailing tool for steel frames



Ayrshire Metal Products has launched a new version of its design and detailing software AyrSuite Plus2. The new tool is available free on request and has been designed to assist structural engineers, consultants, architects and steel fabricators.

Ayrshire says that a number of new functions have been integrated into the new version, making it more comprehensive and easier to use. A new steel frame optimisation feature allows automatic selection of the most cost effective solutions for

sections, bracings and openings.

BRE's automated wind speed and dynamic pressure programme BreVe is embedded into the new version. It makes the calculation of location specific wind cases quicker, easier and more accurate.

Another new feature is its Balanced Airflow calculator which automatically works out internal pressure, using both BS6399 and the method laid in the SCI guide, and then points the specifier towards the most economic design.

Other new features include C-

Detail for floor beam and accessories. Within the steel framing module, floor/ceiling joists design criteria are now expanded to include floors with vibration and ceilings with access.

The framing Design and Detail module now also includes automated fixing design and selection to ensure that designers can advise installers of the requirements when fixing panels to hot rolled steel or other materials.

To obtain a free CD with AyrSuite Plus2 Tel: 01327 300990 or email sales@ayrshire.co.uk

Student accommodation for steel city



Steelwork erection has recently been completed on the Broad Street student accommodation project in Sheffield, one of many multi-storey developments currently under way in the city centre.

Robinson Construction has fabricated, supplied and erected more than 2,000t of structural steel for the project's four separate blocks, as well as installing 30,000m² of metal decking.

Three of the structures, known as blocks A, B and C consist of 10 storeys of student flats. Block D is slightly higher with 12 storeys and also incorporates a ground floor retail level and a basement car park.

"Block D is at the bottom of the sloping site and although it is taller than the other structures they will appear to be the same height," explained Dave Jackson, Sales and Marketing Director for Robinson Construction.

More than 800t of steel was erected in Block D, twice as much as the other buildings. "The retail loadings required heavier sections and consequently more tonnage," added Mr Jackson.

Retail giant gets mega distribution centre

Work has recently been completed on a new Tesco distribution centre in Livingston, which is believed to be largest building in the UK.

Main contractor Taylor Woodrow completed its design and build contract in 65 weeks and work included in excess of 900,000m³ of bulk earthworks and 3,730 driven piles. The 304,800m² warehouse also required steelwork contractor Atlas Ward Structures to erect 3,500t of structural steel.

The building, which is over half a mile long, includes three office areas and a restaurant. The project also involved extensive highways works and parking facilities for 1,000 people working in two shifts.

The distribution centre is a mixed ambient, chilled and frozen depot with ancillary buildings servicing the whole of Scotland.



Diary

For the BCSA seminar contact David Moore, email david.moore@steelconstruction.org

For all Corus events visit www.corusevents.com, email events@corusgroup.com telephone: 01724 405060

5 February 2008
New Welding Coordination Requirements for Structural Fabrication

National Motorcycle Museum, Birmingham.

£145+VAT BCSA members
£175+VAT non-members.



6 February 2008
Steel: The Show 2008
The Westbury, Dublin,
Free



26-28 February 2008
Futurebuild 2008

Earl's Court, London

Corus will be exhibiting at the show. If you are visiting the exhibition, please come along and join them.



12 March 2008
Steel: The Show 2008

Thorpe Park, Leeds
Free



The SCI provide a range of in-house training courses to both

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Steel is wizard, says Oz

Steel works for sport: BCSA delegates at the Gold Coast Titans stadium in Queensland.

Roger Pope reports on a successful BCSA mission to Australia in November which found that major companies like Multiplex are turning their backs on concrete in favour of constructional steelwork.

The objectives of the 19 strong mission were to attend the meeting of the International Steelwork Contractors Group, to join the Australian Steel Convention in Sydney and to visit local steelwork contractors and steel construction sites.

International Steelwork Contractors Group

The ISCG is a forum established for the exchange of views between steelwork contractors and trade associations based in several countries. In addition to the UK and our Australian hosts, the following other countries are represented: Canada, New Zealand, South Africa and the United States.

The ISCG was briefed on the economic prospects and the market outlook for steel and steel construction by Australian specialists from local steel producers BlueScope Steel and OneSteel. The projections were very positive with the demand for steel worldwide being buoyant in the next few years. This in turn is leading to a significant rise in demand for steel construction associated with mining and steel processing. The global figures are staggering with China alone using 62% of its 444 million annual tonnes of steel in construction related work. Yet, even at that level, their steel usage per capita is only 265 kg pa compared with a 450 kg figure typical of developed countries.

There were significantly different views on the

outlook for steel construction seen from the perspectives of the six countries represented. Both Australia and South Africa are experiencing booms due to the demand for their raw material resources. This is also leading to demand for power plants, commercial and residential premises to serve the booming economies. It is also sucking in qualified personnel from New Zealand and causing some problems there.

Canada is seeing very significant differences across the country with the West being most positively affected by global trade and demand for resources. Alberta is benefiting particularly from the development of tar sands. However, in the East manufacturings' dependence on the US, where credit uncertainties and an 'overhang of too much built real estate property', are affecting the business confidence to invest. Aside from the demand side issues, the US is experiencing supply side changes with 'integrated project delivery' becoming mandatory for larger projects. This is blurring the distinctions between the design teams and the contractors.

Nevertheless, overall the outlook was as positive all round as it has been for many years. One issue of concern is the penetration of imported steel products of doubtful quality – fasteners and hollow sections were identified. The introduction of CE marking in the European Union will provide better assurance of quality through the supply chain as manufacturers



BCSA President Richard Barrett outlining steel's sustainability credentials at the Australian Steel Convention

will need to have their factory production systems audited regularly and only by approved certification bodies. This may mean that the CE mark becomes a mark of quality that other countries might value. Otherwise, if the EU initiative is successful, products of dubious quality will be re-routed to countries without such controls.

Increasingly the standards that apply to steel construction are agreed internationally. For instance, EN ISO 3834 is effectively the world standard for welding quality management; and the BCSA's initiative to introduce its requirements through the NSSS is being repeated in other countries.

One ambition of the ISCG is to develop synergies from such discussions and the Sydney meeting agreed that sustainability was the priority for joint action. Richard Barrett, BCSA's President, was asked to chair an ISCG Sustainability Task Group with the objective to use the international framework provided by the ISCG to develop steel as a sustainable form of construction in terms of economic viability, social progress and environmental responsibility. This objective is modelled on that adopted by the BCSA in its sustainability charter.

The Task Group decided that its priority should be to understand the issues behind carbon footprinting and to promote ideas for best practice. In particular the adoption of the whole life approach was agreed as crucial as it properly values the benefits from steel being the most recycled frame construction material.

Australian Steel Convention

The convention was aimed at the whole steel supply chain from steelmaker to erector. Some years ago Australia's biggest company BHP divested itself of its steelmaking to concentrate on the resources sector. BlueScope Steel and OneSteel were floated. Kirby Adams the Managing Director and CEO of BlueScope Steel predicted further consolidation of ownership in the steelmaking sector, good growth powered by Chinese demand and notably that the sustainability agenda is crucial.

This conclusion from Adams' keynote presentation was picked up by Nigel Howard of BRANZ and Andrew Marjoribanks the Chair of the Australian Steel Institute's Sustainability Group. Howard

emphasised the importance of proper weighting of the credentials of competing materials, citing the international acceptance that only Life Cycle Assessment (LCA) should be used to assess materials and products. Listing 19 "green schemes" in use worldwide, including BREEAM, ENVEST and LEED, Howard agreed that LCA is complex and stated that, of the main tools, only BREEAM has credits based on LCA. In other schemes the recycling credit can be dysfunctional, leading to no additional recycling of steel. In short, steel scrap is too valuable to not be comprehensively recycled from wherever it arises.

The convention delegates heard from Alison Mirams, Regional Construction Director with Multiplex Constructions on her "Success with steel buildings". Simply, Mirams advocated the use of steel frames rather than concrete. Using recent and current examples like Latitude East in Sydney, Mirams showed how steel was cheaper and quicker and explained that Multiplex was committed to steel-framed buildings in Australia.

Additional key benefits she cited for steel were reduced weight and off site prefabrication. Automated manufacture resulted in greater accuracy and far less site waste. Steel required fewer people on site making steel safer than concrete – the stripping of formwork being the most hazardous site activity.

Mirams stated that the choice of steel enforced a stricter discipline at the pre-construction stage as off-site manufacture required strict administration of the necessary drawings and meant that late variations would carry a penalty for any rework on site.

The time savings led to reduced preliminary costs, earlier lift room handover, earlier access for services, hoists and cranes being removed earlier and as the building is commissioned earlier this results in reduced financing costs.

Her only major concern was that fire engineering is a developing science and can create uncertainty as to what level of fire rating building control authorities would accept. Finally, Mirams advocated single-point responsibility in which a steelwork contractor undertakes design, supply, fabrication and erection of the complete frame package – a model that is already the norm in the UK but not generally so in Australia yet.



Steel hotel for historic football ground

Sheffield United FC's hotel has been partially built over an existing entrance to Bramall Lane stadium. The thoroughfare needed to be kept open to the public during the construction programme and this led to the decision to use steel.

Bramall Lane, the home of Sheffield United Football Club, has seen many changes in its long and illustrious history. The ground has the distinction of being the oldest major stadium in the world still hosting professional matches, with the first football played on the site way back in the 1870s.

The famous city centre stadium started life however as a cricket ground and two sports shared the facilities until the 1970s, when the old pavilion was finally demolished and the outfield built-over to make way for a new stand, finally enclosing the football pitch.

The differing dimensions of cricket and football pitches meant that after building over the pavilion the club inherited a large vacant lot of land behind its new South Stand. This area has been used as the main car park and recently was earmarked for a new stadium development.

"There is an existing exit ramp from the stadium and the hotel structure had to be constructed over it partly as a cantilever."

The first part of this work is a 158-bedroom four-star hotel which will include executive suites, a fitness centre, restaurant and bars. When complete it will be operated by Millennium & Copthorne and will be one of Sheffield's largest hotels.

The new structure is located on the corner of Bramall Lane and Cherry Street, and next to - but

not adjoining - two of the ground's stands. This close proximity to the stadium was one of the main reasons why steel was chosen as the main framing material.

Mel Risbin, Director of 3E Consulting Engineers, explains: "There is an existing exit ramp from the stadium and the hotel structure had to be constructed over it partly as a cantilever. Using concrete would have meant extensive temporary propping for two or three months in this area and this would have meant closing the ramp and losing ground capacity. We suggested steel as the best solution."

"It was easier and quicker to design and build this part of the structure in steel. The client was then persuaded to go with the material throughout the project for continuity."

The challenge was to keep the same grid pattern of 3.9m centres. Mr Risbin adds: "This was achieved towards Bramall Lane with one column piercing the ramp to take the loadings and this member has been boxed in to form an architectural feature."

At the rear of the cantilever section the main column is 4.65m from the outside edge of the cantilever. This results in the upper cantilevers of 3.9m being supported by a column, which in turn sits on a cantilevered plate girder at first floor level, supported by a column offset by 0.75m, thereby achieving the required 4.65m.

Adjacent to the ramp exit there is also a turnstile block which had to be incorporated into the hotel





FACT FILE

Millennium & Copthorne Hotel, Sheffield United Football Club

Main client:

Sheffield United F.C

Architect: WCEC

Structural engineer:

3E Consulting Engineers

Main contractor:

GMI Construction

Steelwork contractor:

Elland Steel Structures

Steel tonnage: 450t

Project value: £17M

Above: The hotel is situated within the stadium's car park.

Below: One section of the structure had to follow the irregular pattern of the adjacent stands.



Left: The completed hotel will be one of Sheffield's largest.

Below left: The hotel was constructed over an access ramp and a turnstile block. Below: Erecting the feature facade along Bramall Lane.



structure's design. Main contractor GMI had to have this block completed and ready for use by the start of the current football season last August.

The original brick turnstile block was demolished and completely rebuilt during the summer, leaving the steelwork to be erected before the imminent football season.

"We had an initial three week period on site erecting all the steelwork above the turnstiles and the ramp," explains Elland Steel's Contracts Manager Mike Hill. "As this section of the hotel abuts and follows the shape of two of the stadium's stands it has a complex and angled shape, but the erection was still done in the allotted time scale."

Apart from the turnstile block and the ramp there is little interaction with the stadium next door and construction work has even been able to continue during match days. "It was important to complete the initial corner section over the ramp to allow public access to the stadium," adds Mr Hill. "Once this was complete we then began an 11 week steelwork programme in late August for the rest of the seven-storey structure."

As the hotel is located in the stadium's car park, which is in use all week, deliveries to site and plant equipment movements had to be carefully coordinated. It also meant the steel erection was done within the project's footprint with the aid of one mobile crane and a couple of cherry pickers.

"As we erected steel our available space for the crane and steel storage progressively got smaller," adds Mr Hill. "Bramall Lane is also a busy major route into the city so we couldn't put any equipment in the road and had to erect this main facade from within the site's footprint."

GMI initially came on site in May and began by leveling the sloping site and digging out the

basement level. A concrete slab was then poured and piling was undertaken, which primarily consisted of ground anchors to prevent up-lift.

The structure has a footprint of approximately 700m² and the gridline pattern stays uniform on the upper bedroom levels. The lower levels differ slightly because of the access ramp and the need for larger column free areas for the reception area on

Construction work has even been able to continue during match days.

the ground floor and a restaurant and gym on the first floor.

Mr Hill says the steel erection was fairly regimented after the first two floors, but

there is a feature cantilever at front of the hotel. This is the facade for the gym and has been described as a 'propped cantilever'.

This architectural facade consists of beams that protrude by 1.5m, supported on main perimeter columns. "Erecting the steelwork above this cantilever from within the project's footprint was another tricky procedure," adds Mr Hill. "Ordinarily on a greenfield site this wouldn't have been so difficult, but on a tight inner city site steel erection is more of a challenge."

Summing up the design and vision of the project - especially the main facade's cantilever - Ashley Turner, Partner at WCEC, says the dramatic, modern architectural design of the hotel is strongly modelled to contrast with the flat facades of the existing street scene.

"This development heralds the economic regeneration of this area of Sheffield and will provide a major financial boost for the region. The arrival of the hotel will create a substantial number of jobs."

Futuristic offices will transform city

A design and build programme has played a vital role on a multi-storey project in Birmingham where a number of innovations have considerably reduced the construction timetable.

Steelwork erection has recently been completed on the first of three tower blocks which are set to transform the Snow Hill area of Birmingham. Provisionally known as Snow Hill Building One, the steel-framed building will offer 11 floors of modern office space over a ground floor reception and retail area and three basement car park levels.

Situated next to Snow Hill Railway Station, the fully glazed building forms the initial part of a much larger project which will include another office block, a hotel, leisure facilities and luxury flats.

Project developer Ballymore says the scheme will bring a sizeable chunk of Birmingham city centre into the 21st century and enhance the whole area by creating a high-quality mixed-use scheme.

Building One has one main concrete core, which provides overall stability, and has a footprint of approximately 30,680m². The most eye-catching elements of the completed building will be the almost total use of glass cladding and one facade which slopes outwards by six-degrees.

Sustainability has played a key role in the design of the block and the glazed nature of the structure will allow daylight penetration into the building, thereby helping to reduce the energy demand from lighting.

Steelwork contractor for the project Barrett Steel Buildings has undertaken a design and build contract. Richard Beesley, Technical Director at Barrett, says this has led to a number of benefits for the client. "We already had 80% of the overall steelwork design done during the tender stage and as steel was chosen for its speed, our early work in the programme helped quicken the job."

Initially the client's design incorporated a steel

framed structure starting at ground floor slab and three basement levels constructed with a reinforced concrete (RC) frame.

"Kier Build suggested an alternative design with steel columns springing up from piles at basement level," explains Mr Beesley. "This has saved a considerable amount of time."

Once the steel columns were erected for the basement car park, the steelwork to the suspended ground floor was installed. Barrett then erected the 11-storey frame above this concrete base. Below the slab Barrett had already left studs on the columns which allowed Kier to erect the RC basement beams later on.

"This meant Kier was able to erect these slabs while we were erecting the main frame," adds Mr Beesley. "Working simultaneously like this was a

"Ordinarily the main frame wouldn't have been erected until the concrete podium had been completed..."

quicker solution and one which Kier was keen on."

The upper floors of the building have already been pre-let and fit-out needs to begin as soon as possible. The glazing

will begin to be installed at the upper levels while the RC beams are being positioned at basement levels, again saving time by allowing trades to work simultaneously.

"Ordinarily, the main frame wouldn't have been erected until the concrete podium had been completed," explains David Hughes, Technical Director of Curtins Consulting. "This has shaved about three months off the schedule."

Below: Building One is the first part of a regeneration project which will transform Snow Hill.



FACT FILE

Snow Hill Building One, Birmingham

Main client:

Ballymore Properties

Architect: Fairhursts

Concept architect:

Sidell Gibson Architects

Structural engineer:

Curtins Consulting

Concept engineer:

Alan Baxter Associates

Main contractor:

Kier Build

Steelwork contractor:

Barrett Steel Buildings

Steel tonnage: 3,000t

Project Value: £66M

centre

Above: The sloping facade has two 18m wide cranked sections.



Above: The Snow Hill development will revitalise an under-used city centre area.

Below: The sloping facade is formed with columns which lean outwards by six degrees.



For the steel frame Barrett split the project into halves and erected three floors on one side before moving over to the other. This allowed the decking to be laid on the first side as well as the concrete floors. The programming meant Barrett was always erecting steelwork at least two levels ahead of the concreting team.

Barrett also made use of skid tracks which can accept a cherry picker's wheels and allow the machine to work on decking without damaging the metal. Certain beams had welded studs which accepted the tracks, and the process meant the steelwork contractor had to make sure these selected beams were sorted on delivery and only used at the chosen areas where the cherry picker would stand.

"This speeded up the steel erection as we had no need to wait for the floors to be concreted," explains Tony Power, Barrett's Safety Manager.

Hot rolled angles with welded stubs were supplied to the edge beams. This enabled the temporary edge protection to be fixed on the ground and then lifted into place. The angle formed the concrete edge trim so the decking sub-contractors did not have to go outside the edge protection to install the concrete edge trim.

"This meant the edge panels were simply slotted into place," says Mr Power. "These brackets, like the studs for the skids, are sacrificial and will be cast into the concrete floors. Designing for safety at the earliest possible stage reduces risks during construction."

Structurally the building has a grid pattern of 9m x 9m, except for the ground floor reception area which has slightly longer spans, although the facade facing Snow Hill Station slopes and requires perimeter columns on this line to be cranked.

The sloping facade consists of two 18m-wide sloping sections formed by a series of cranked columns springing off the podium.

"Each floor is tied back to the core, which in turn takes the horizontal loading," explains Mr Hughes. "To counter this, each floor has two lines of braced bays on the opposite side of the core."

The building also incorporates a large central atrium which extends right through the structure starting at ground floor level. The feature will have an ETFE roof and will allow daylight into the structure's innards. The atrium is approximately 18m x 9m at it largest, but varies in shape on almost all floors.

The atrium steps in and out at various levels and also includes steel bridges at the sixth and eighth floors. This irregular shape doesn't, however, interfere with the structure's grid lines.

Summing up the steelwork package and the advantages of a design and build contract in the early stages of the project Mr Beesley says: "We made an original design model for the steelwork, which then only needed to be slightly refined to turn it into a fabrication model. This made the initial in-house design process a lot quicker and simpler. We sent updated models regularly to the design team which allowed them to review the 3D structure in real time."

All perimeter beams have welded pockets to accept and aid quick installation of edge protection.

Commercial



FACT FILE**St David's 2****development, Cardiff****Main client:** Land Securities and Capital Shopping Centres**Architect:** Benoy**Structural engineer:**

Ramboll Whitbybird

Main contractor:

Bovis Lend Lease

Steelwork contractor:

William Hare

Steel tonnage: 16,000t**Project value:** £675M


Transfer structures kick-start Cardiff retail project

The John Lewis anchor store is a stand-alone structure which shares the project's basement level.

The original design for the St David's 2 project in Cardiff has been modified to incorporate greater use of steel. This has produced a scheme which is proving to be quicker and more efficient to build, primarily because of a number of transfer structures reports Martin Cooper.

On leaving Cardiff Central railway station one can't help notice how much construction activity there is currently in the city. The place is a hive of building work and the largest and most prominent project, by far, is the St David's 2 development.

This giant mixed-use scheme in the heart of the Welsh capital will transform a large swathe of the city centre and includes a 24,163m² John Lewis department store, an indoor retail mall with 89,881m² of medium-sized stores, car parking for 2,500 vehicles, restaurants, bars, public amenities, a residential apartment block and affordable housing.

Predominantly retail-led, the project is one of the most important city developments in the UK and is currently the largest private financial investment in Wales. Situated on the site of an old shopping mall and car park, the scheme also incorporates the redevelopment of the adjacent and existing St David's centre which will be linked into the new scheme via a footbridge.

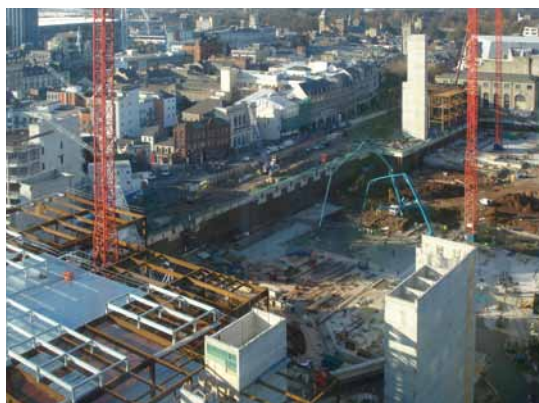
Main contractor Bovis Lend Lease has a £300M design and build contract for the new build, and a further £40M contract to refit and enlarge the existing shopping centre.

"The old centre will have one extra floor added above Debenhams and a bridge will then allow both centres to form one large shopping mall," explains Nick Wylie, Bovis Project Director.

Work on site started in earnest early last year with a large-scale demolition scheme followed by an earthmoving operation which saw 270,000m³ of



The retail mall has three levels consisting of two pedestrian walkways and a mezzanine floor on the upper level.



overburden removed to create the project's 10m-deep basement level.

The sub-structure of the project consists of a concrete raft slab - with more than 5,000t of rebar - with a steel main frame springing directly up from this. "We worked closely with the engineers to design and modify the original design into a part-steel, part concrete structure," explains Mr Wylie.

The two basement car park levels are subsequently formed with steel columns and beams. Above this there are ground floor steel transfer beams which then supports the three floors of retail in the shopping mall and also the three trading levels of the John Lewis store.

Although the John Lewis anchor store is essentially a stand alone steel structure and linked to the rest of St David's 2 by two bridges, it does however share the basement car park levels.

Using steel for the substructure and ground floor transfer structure brought with it a number of cost and programme advantages. "Steel was a major part of our tender," says Mr Wylie. "A steel transfer structure, as opposed to a concrete one, is more efficient as it is shallower and required less dig, which then resulted in fewer truck movements."

The ground floor is the project interface between the retail structural grids and the car park. "This called for the use of transfer beams," adds Mitesh Patel, Associate with Ramboll Whitbybird. "These transfer beams are steel plate girders in lieu of a post-tensioned solution, previously suggested, and therefore they avoid the need for progressive post tensioning, sliding bearings and substantial movement joints."

There are three types of transfer beams used at ground level. The first type occurs where the retail/upper car park sits above the service yard. Nominally these transfer beams are 22.5m long, but in order to minimise the section depth the transfer beam is continuous with two adjacent spans.

The second type of transfer beams are used where the main retail/residential area sits above the basement car park. These have up to four adjacent spans with a maximum length of 16m. The third type occurs where the anchor store sits above the car park, here there are up to four adjacent spans with a maximum length of 16.2m.

"These beams aren't necessarily the lightest sections available, but importantly they allow reduced overall storey height in the basement car park," explains Mr Patel.

The ground floor transfer beams were generally installed in lengths of up to 16m, each 1.5m deep



Far left: The project initially required a large earthmoving operation with 270,000m³ of overburden removed.

Left: John Lewis is separated from the main retail area by a pedestrianised street.

and weighing on average 20t. They also take into account the differing grid patterns of the basement levels and the upper retail zones. The basement car park has a 16m x 9.6m grid and this reduces to 7.5m x 8m for the retail mall area, and 9m x 9.6m in John Lewis.

Mr Wylie says the speed of construction, associated with steel, has played an important role. "Steelwork has been erected simultaneously with the concrete being laid. Once concreting has been done in one area, it is then handed over to William Hare and they begin erecting steel immediately."

Bringing steel and other materials to an inner city site, surrounded by busy roads, can be problematical and the St David's site is no different. Even though the site covers a large area there is still little room for storage. All materials, are closely coordinated and brought to site as needed from a large storage depot Bovis has acquired outside of the city limits at Wentlow.

Another structural challenge was presented by the mall's roof. This forms the interface between the retail steel structure and the post tensioned concrete structures that form a 1,900 space multi-storey car park and seven-storey residential blocks. Here there was also the need to install large transfer structures to accommodate differing grid lines.

The multi-storey car park predominantly follows the same layout as the retail zone below, but the residential block's foot print is reduced in comparison. This change in floor plate entails that very few of the cores used for the stability in the retail structure can be used in the residential block. Therefore cores have been incorporated within the residential area to provide stability. These cores start above the retail zone and require steel transfer structures below them to distribute the load out to the columns and then into the foundations.

To enable future flexibility within the structure and simplify the process for the manipulation of the building to suit initial and future tenant requirements, a degree of redundancy has been built into the structure.

"This should help increase the life span of the building, allowing it to evolve with an ever-changing retail market," adds Mr Patel.

William Hare began steel erection in September 2007 and is scheduled to complete its work this summer. The retail part of the project is then scheduled for completion in September 2009 with John Lewis handed over 13 months before this date for fit-out. The residential part of the project will then be completed by 2010.

"These beams aren't necessarily the lightest sections available, but importantly they allow reduced overall storey height in the basement car park."



Top: Transfer beams at ground level between the car park and the retail trading zone take into account the differing grid lines.

Above: Transfer beams are installed in 16m lengths.

The case for steel

Nick Barrett starts a series of articles that will provide designers with a comprehensive outline of why their choice of constructional steelwork represents the value for money option with an overview of the case for steel.

One way to show that safety is truly being put first is to select steel.

The case for using steel as a construction material in the UK is overwhelmingly strong, so much so that it dominates the market as a building framing solution and for longer span bridges to a greater extent than anywhere else. Why do designers increasingly find structural steelwork to be the first choice building material?

Safety record sets steel apart

Health and Safety is often cited as the priority by developers, designers and contractors alike, and one way to show that safety is truly being put first is to select steel. The sector enjoys an enviable safety record. Most of the work is already done by the time steelwork arrives on site, in the factory-controlled conditions of the fabricating shop where the latest machinery ensures safer working conditions for fully trained, skilled workforces.

On site operations are inherently safer than with alternative materials. In place of gangs of shuttering joiners and other trades, constructional steelwork is erected quickly and safely by small teams of certified specialists, overseen by erection experts with a wealth of experience. Work at height takes place in the secure environment of a mobile platform in which operatives are secured with fall arrest equipment.

BCSA members have been at the fore of developing innovative safety systems that benefit all workers on projects they are involved in, like edge protection systems and safe loading and unloading procedures.

Below: Steel buildings can be extended both vertically and horizontally, thereby lengthening the structure's life.

Vibration standards easily achieved

The long span solutions offered by steel are easily achieved without any special strengthening being required to meet even the strictest requirements for vibration performance in the National Health Service. Floors provided to these 'hospital specifications' are lighter than concrete alternatives. Assessing structures for performance in use is easily achieved with steel framed buildings, using calibrated, proven design rules.

Post-tensioned concrete flat slabs raise their own vibration issues, and in some parts of the world previously high profile supporters of this technique are turning their backs on it in favour of steel.



Acoustics

Careful detailing is needed whatever framing solution is adopted to ensure that a building achieves the required acoustic performance. Tested details are available free for steel solutions. Steel infill walls are lighter and narrower than concrete block equivalents.

Steel is the sustainable solution

Steel has possibly the strongest sustainability case of all construction materials. As it is so easily recycled steel in use represents a positive store of value to society. Concrete on the other hand leaves a substantial legacy problem that threatens to blight some potential redevelopment sites.

Using steel lengthens the life of buildings as they can be easily extended vertically and horizontally and adapted to the changing needs of building users. When it is decided to completely redevelop, the sale of scrap steel helps defray development costs.

Floors in steel framed buildings commonly





Above: Severfield Rowen extensively used mock-ups for key structural steel elements for the T5 project.

Left: Glasgow's Stobhill Hospital is one of many recently built hospitals where steel has met all NHS vibration criteria.

Steel solutions deliver longer spans with column free spaces, small columns, lightweight solutions, shallow floors and integrated services.

provide all the thermal mass that is required for efficient heating and cooling.

Proven performance in fire

Steel has a proven performance record in fire, whereas other materials have at best patchy test histories and as a result their performance in real fires can only be guessed at. The steel sector has consistently funded comprehensive research over a period of many years so that the performance of steel in a fire can be reliably forecast. The cost of fire protection has fallen considerably over the past 20 years or so and intumescent are now routinely applied offsite. New design techniques using finite element analysis are highlighting where fire protection can be safely and cost effectively eliminated, and where additional protection could be best applied.

Quality assured product

All steel sourced from Corus, the UK's leading steel manufacturer, is CE marked, with all that implies in terms of guaranteed quality and provenance. Use of 3-D modelling, CE marking, numerically controlled fabrication and offsite production all add up to steelwork being a high quality product supplied to site with minimal defects. Steelwork contractors now commonly cooperate with designers and clients to such an extent that key structural solutions can be trialled before going to site using mock ups, as was done at Heathrow Terminal 5 by Severfield Rowen for client BAA.

Cost effective framing solutions

For many, the financial case for using steel is perhaps the strongest. The cost of constructional steelwork has fallen significantly in real terms over the past 20 years thanks to massive productivity improvements made by Corus, steelwork contractors, intumescent paint manufacturers and others in the supply chain that have been shared with clients.

Independent studies consistently show that steel provides the most economic solution in most cases – the market obviously agrees as steel now commands over 70% of the market for multi storey buildings. Value engineering usually results in steel being chosen in preference to any concrete alternatives that might have been considered.

Supply chain

The strength of the steel supply chain, from the Corus steelworks and mills through fabrication to erection on site, is one of the most striking charac-

teristics of the UK construction market. There is a wide range of highly skilled and experienced steelwork contractors able to tackle the most complex and technically challenging projects and play an active role in developing cost effective and innovative design solutions. They ensure a competitive tendering environment, compared to projects using other materials that might at best attract only two bids.

The supply chain has a long history of producing innovative solutions. Corus for example recently introduced its rebranded quality assured CE marked Advance range of steel sections, bringing new standard section sizes to the UK market for the first time.

Steelwork contractors have invested heavily in state of the art CNC machinery which means continuous improvements in quality and productivity, all to the benefit of designers and building owners and users.

Structural solutions

Shallow depth floor solutions are one of the factors that set steel framed buildings apart. Despite the claims that may be made by others from time to time when it is required to have floors accommodate services steel provides the shallower solutions. Slimflor solutions or bespoke fabricated beams provide very shallow floors to meet the most demanding client needs. Solid slab concrete floors are heavy, with cost implications for both the structures and foundations of buildings.

Steel solutions deliver longer spans with column free spaces, small columns, lightweight solutions, shallow floors and integrated services.

Sector support

Underpinning all this is the huge investment in research and development and technical and marketing support provided by Corus, the BCSA and the Steel Construction Institute. The sector carries out a great deal of development work of its own and cooperates with universities in the UK and worldwide to ensure continuously developing technical excellence.

Technical support is offered to designers on a scale unprecedented in construction. Everything that can be provided to make designing in structural steelwork easy is made available.

(In the next article we will look at reasons why constructional steelwork represents Quality Construction.)

FACT FILE

Princess Elizabeth Hospital, Guernsey

Main client:

States of Guernsey

Architect:

Nightingale Associates

Structural engineer:

WSP

Main contractor:

Charles Le Quesne

Steelwork contractor:

Hambleton Steel

Project value: £27M

Steel tonnage: 650t

Island's healthcare gets a boost from steel

Getting the steel supply to the island was a logistical challenge which had to be overcome before construction work could begin on an extension to Guernsey's main hospital. Martin Cooper reports from the Channel Islands.

Below: Feature tubular columns surround the courtyards.

One of the most important public works projects under way on the island of Guernsey is the expansion and redevelopment of Princess Elizabeth Hospital.

Originally built in the late 1940s, the hospital, which is the island's largest, is undergoing a phased modernisation programme, with a new £27M clinical block representing Phase 5.

Scheduled to open in 2009, the new block is being built on ground previously occupied by hospital staff residences and a car park. The previous phase of hospital construction work saw a new staff residence block - John Henry Court - built, and its completion enabled the old building to be demolished, freeing up land for Phase 5.

The new three-storey block has a total floor area of 11,000m² and connects into the existing hospital building over two levels.

"When we initially came on site in January 2007 the first job was to dig out and level the ground," explains Alan Rogers, Project Manager for Charles Le Quesne. "There was a very significant earthmoving operation as we had a sloping site which then

meant we needed to install a large retaining wall."

Piling work commenced in March and concrete pad foundations were installed to accept the steel columns.

When it came to designing the new hospital block, Project Architect, Simon Boundy, says marrying and tying the new structure into the existing hospital was of paramount importance.

"This phase is the largest and the driver for the whole redevelopment, consequently we wanted the structure to make a contemporary statement."

The existing hospital buildings are steel framed, so using steel meant marrying together the same framing material at the point where the blocks meet. Jamie Siggers, Associate at WSP, says tying the new build into the existing structure was a challenging aspect of the design and required some tricky solutions. "We had to thread the new steelwork into the old building, while avoiding all services."

Vibration can sometimes be an issue, especially on hospital projects, but Mr Siggers says all concerns were thoroughly checked with SCI guidelines.



Above: The top floor will house a training area as well as plant rooms.



Left: Once construction work has been completed the set-down area will be turned into a car park.

"Sway wasn't an issue either," he adds. "As steel bracing on all floors takes care of this."

"The overall design and the need for varying room and ward sizes meant steel was the obvious choice," says Mr Boundy. "And, in some areas the steel columns are left exposed as architectural features, and this wouldn't have worked so well in concrete."

The contemporary design will also be achieved by the block's distinctive cladding which is a combination of terracotta rainscreen, zinc and timber cladding, together with some large glazed areas. This exterior design mirrors the recently completed, and adjacent, John Henry Court.

Once steel was chosen as the framing material, steelwork contractor Hambleton Steel then had the logistical problem of getting the material across the English Channel to Guernsey.

As with most construction jobs undertaken on the Channel Islands, the majority of materials have to be brought in from the mainland. This involves close cooperation with the shipping agents and means a

"The overall design and the need for varying room and ward sizes meant steel was the obvious choice."

lot of thought needs to be given to delivery batches.

"We've done jobs in Guernsey before and we basically refined our procedure from a contract we did earlier this year," comments Andrew Fixter, Project Manager for Hambleton Steel.

Hambleton sent batches of erectable loads, but also split these loads down into smaller batches. One containing steel members of less than 6m lengths and another with the sections longer than 6m. This procedure was worked out with the shipping company and was considered to be the optimum way of loading the goods onto the ship at Portsmouth.

"Once we'd got the steel batches onto a ship we had to make sure it could be erected almost immediately," adds Mr Fixter. "The hospital site is quite confined with little or no room for storing materials."

This meant close cooperation between those sending the batches from Hambleton's Yorkshire fabricating yard and the steel erectors on site in Guernsey.

"We had some leeway as the shipping company would allow us to leave some steel sections at the port in Guernsey, for a while," says Mr Fixter. "But essentially everything was sent in loads which were then immediately erected."

Accuracy was a key element of Hambleton's steel delivery and shipping process and Mr Fixter says it 'worked like clockwork' during the company's 20-week steel erection programme.

Mr Rogers agrees and says the sequence worked out between Hambleton and the shipping company was vital to the successful steel erection. "The majority of construction materials come from the mainland and a good working relationship with the shippers is important.

"The beauty of steel is that it can just be brought to site and then put up and bolted straightaway," he adds.

As the construction site is next to a functioning hospital noise and traffic movements need to be kept to a minimum. Steel deliveries were generally restricted to one a day early in the morning to avoid heavy traffic and cause the least disruption.

Overall the building is formed by two conjoined T-shapes in plan, which then form two enclosed inner courtyards.

One courtyard is completely within the new building, while the other is formed from the new block and existing structures.

"The courtyards are essential to the design as they provide quiet areas for patients to sit and recuperate," explains Mr Boundy. The hospital wards then wrap themselves around these courtyard areas, with most floors having views into these landscaped gardens.

The layout of the building's three levels are: ground level, outpatients, wards and private rooms; first floor, wards and private rooms; and second floor, training area and plant rooms.

One of the main features of the new block is the ward and private room layout. A Nightingale designed four-bed bay cruciform layout has been used for all wards. "This gives each ward a reasonable amount of individual privacy," explains Mr Boundy.

The building's uppermost level is topped by a feature mansard roof which incorporates some external plant areas. Flat areas within the roof were considered the best fit for plant as they won't be visible from ground level.

The top floor will be used as a staff training area and one continuous column free area was needed. "It was these long span areas that best suited the use of steel," adds Mr Boundy.



Underfloor heating has been installed throughout the project.



Below: The new structure ties into the existing hospital and forms two courtyards.

Distribution park opens up the South West

Steelwork has recently been completed on the latest warehouses at Cabot Park, the largest multi-modal distribution park in the West Country.



FACT FILE

Cabot Park, Bristol

Main client:

ProLogis

Architect:

Michael Sparks

Structural engineer:

Sprigg Little

Main contractor:

Norwest Holst

Steelwork contractor:

Atlas Ward Structures

Steel tonnage: 2,000t



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Cabot Park boasts road, rail and sea transportation links.

Covering an area of 183 hectares, Cabot Park is a fast expanding multi-use distribution park near Bristol, which also has some of the best transportation links in the UK.

Close to Junction 18A of the M5, the park also boasts an international rail freight depot as well as shipping facilities at the adjacent Avonmouth Docks.

The development is home to a number of well known industrial and retail companies, with developer ProLogis the latest name to be associated with it.

Atlas Ward Structures has recently completed the steelwork for two warehouses on the site for ProLogis, on what is the Pan-European developer's first development in the South West of England.

Working on behalf of main contractor Norwest Holst, Atlas Ward initially supplied and erected approximately 1,500t of structural steelwork for a 50,764m² cross docking warehouse on a design and build basis.

Known as Crossflow 550, the new building, which is funded by GE Real Estate, will create around 600 new jobs in the logistics sector. The warehouse will be ready for occupation within the next few months and joint agents Knight Frank and CBRE, say the scheme has already attracted plenty of interest from potential occupiers.

The warehouse is a five span portal frame structure containing 50 docks along the two side elevations, hips to both ends and a three-storey

office block connected at one corner. The main warehouse dimensions are 5 x 33m spans, 36 x 8.2m bays long and 12m to underside of haunch.

A second warehouse was completed in three weeks.

Andrew Bramley, Atlas Ward's Project Manager, says this project was erected in eight weeks as it is predominantly a greenfield site with plenty of room and good access for deliveries.

"A month after completing the first warehouse we then erected a similar but slightly smaller structure on the same site," he adds. "This was completed in a three week programme."

This second distribution centre has three 28.5m spans, 14 bays of 8.45m, is 10m to underside of the haunch and has 25 docks along one main elevation. The structure is also hipped at both ends and also contains a two-storey office block.

Commenting on ProLogis' decision to move into the Bristol area, Vice President George Glennie said: "We have traditionally developed distribution facilities in the South East and East Midlands, but we recognise that the South West is becoming increasingly important as a logistics hub - particularly in light of EU legislation restricting the distances that commercial drivers can travel in one day.

"With its excellent motorway links, proximity to Avonmouth and its international rail freight terminal, Cabot Park is an ideal location."

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Steel still the cost effective choice

Structural steel framing solutions have again been confirmed as faster and cheaper to build than reinforced concrete alternatives in the latest update of a cost comparison study that dates back to 1993. Nick Barrett reports.

A team including Davis Langdon, Arup and MACE conducted the study, commissioned by Corus. Its results help explain why steel framing solutions continue to dominate as the first choice for multi storey buildings and other structures, as confirmed by a market share survey.

The cost comparison study considers two typical modern commercial developments, Building A which is a 2,600m² office in Manchester, and Building B, which represents an eight-storey prestige office building of 18,000m² in London. A range of steel, composite and concrete based frame solutions for both buildings were fully designed, costed and programmed (see table left).

Graph A (Comparison of steel and concrete

frames and floor costs Buildings A and B – average of all schemes, over page) shows that steel is the cheaper option, as it has been for many years. The conclusions hold

The cost differential between the average steel and concrete options is actually wider today than it was in 1985.

good for other building types in sectors like healthcare, education and retail.

Graph A tracks the average cost per m² for the steel and the concrete frame and floor options. The figures are derived from the cost study conducted by Davis Langdon and are tracked using Department for Business, Enterprise and Regulatory Reform (BERR – formerly Department of Trade and Industry) cost indices.

At June 2007 prices the concrete frame and floor options cost an average of £164.25 per m², as Graph A illustrates. This is £32.29 more than the average steel cost of £131.96 per m². So the



Building A 2,600m ² office, Manchester	Composite steel beam and slab	Slimdek (steel shallow floor solution)	Long span cellular beams	Reinforced concrete flat slab	Insitu frame with precast floors
Frame and floor cost (£/m ² GFA)	108	136	133	156	130
Frame construction time (weeks)	7	6	6	8	8
Overall building cost (£/m ² GFA)	1187	1201	1228	1253	1228
Overall construction time (weeks)	42	40	41	44	43
Building B 18,000m ² office, London	Composite steel beam and slab	Slimdek (steel shallow floor solution)	Long span cellular beams	Reinforced concrete flat slab	Post tensioned ribbed concrete slab
Frame and floor cost (£/m ² GFA)	123	151	149	182	194
Frame construction time (weeks)	13	13	13	18	19
Overall building cost (£/m ² GFA)	1881	1883	1896	1973	1951
Overall construction time (weeks)	67	67	66	76	76



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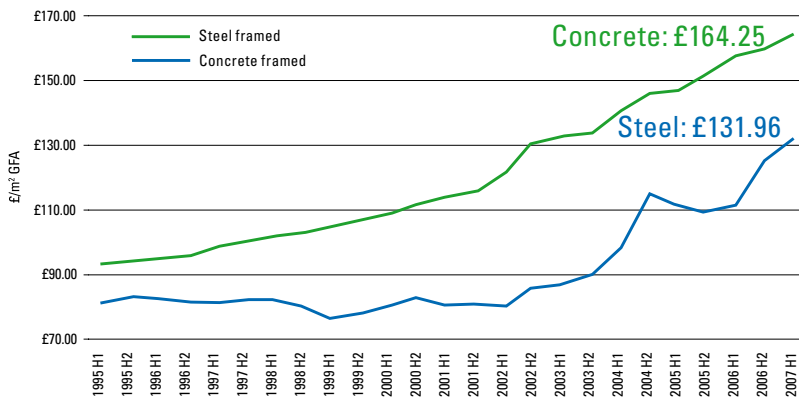
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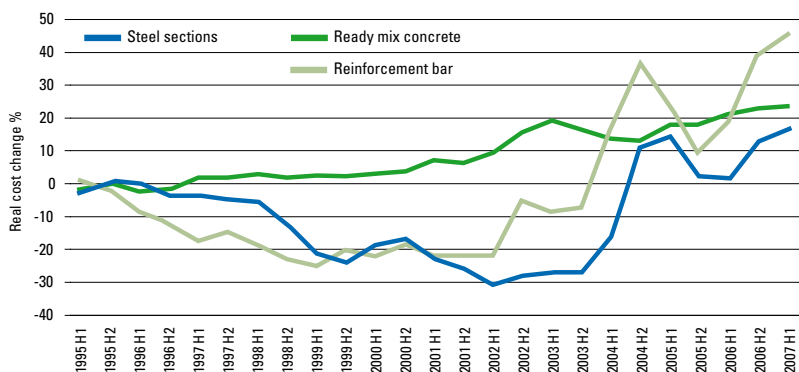
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Cost comparison



Graph A: Comparison of steel and concrete frame and floor costs
Buildings A & B, average of all schemes



Graph B: Raw material costs relative to inflation

cost differential between the average steel and concrete options is actually wider today than in 1995 when the steel options were £14.03 cheaper.

BERR produces monthly statistics tracking material costs against GDP inflation to provide a comparison in real terms (see Graph B: Raw material costs relative to inflation and Graph C: Constructed component costs relative to inflation). Graph B shows that in comparison with 1995, the cost of steel has increased by 17%, but the cost of concrete has increased by 24% while reinforcement bar has increased by 46%

Comparing the constructed component costs of the alternative framing solutions over the same

The selection of a steel frame reduces timescales and has a beneficial effect on other major variable cost items.

period, Graph C, BERR statistics show that the relative costs of the key steel framed building components fire protection and metal decking, have fallen when compared to ready mix concrete

and reinforcement bar, which are key components of concrete frames. This has helped ensure that the relative competitive position of concrete and steel frames remains unchanged.

'These official statistics help explain why the strong competitive position that steel long ago established over concrete remains unchanged,' said Corus General Manager Alan Todd. 'The cost of a frame and floor is a relatively small part of the total cost of a development. However, the selection of a steel frame reduces timescales and has a beneficial effect on other major variable cost items such as foundations, cladding and services,

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'Designers and contractors appreciate the cost and other benefits of steel, of which a strong sustainability case is increasingly important, and this explains why steel frames enjoy a market share of 73% for multi storey frames and dominate the single storey market with a share of over 90%.'

Construction market prefers steel

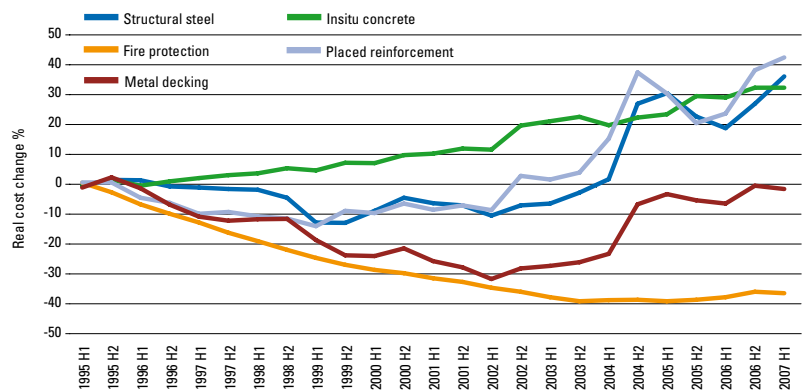
Cost effectiveness is one of the many advantages of structural steelwork. This position is reflected in another long established independent industry-standard survey, which has measured the relative market share of structural frames annually since 1980.

The most recent results, see Graph D: Market share for steel and concrete frames UK Multi storey buildings, show that steel is preferred as a framing solution for over 73% of multi-storey commercial buildings, while insitu concrete accounts for 18%. The remaining 9% of the market is attributed to load bearing masonry, pre-cast concrete and timber.

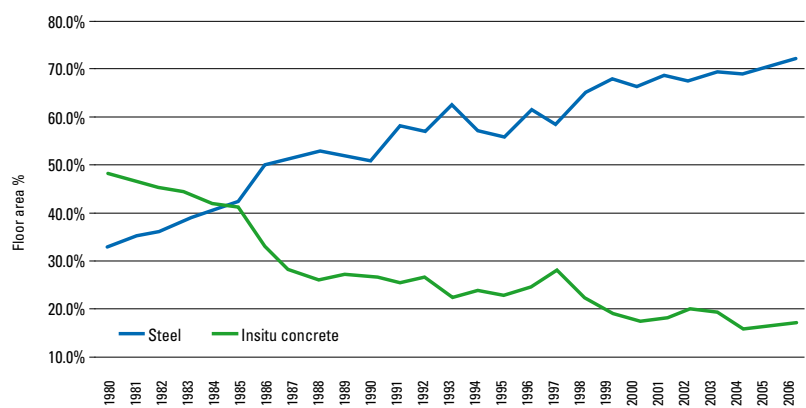
Mr Todd concluded: 'This strong performance in driving down costs in real terms over so many years is testament to the commitment of the entire constructional steelwork sector to first of all improving its own productivity and then sharing these benefits with customers.'

'Steel designers have the widest possible range of in depth technical back up from the steel sector to ensure that their task is as straightforward as can be. Corus and all of its partners in the steel sector are dedicated to ensuring that this support continues and is developed further.'

For further detail please visit:
www.corusconstruction.com/coststudy



Graph C: Constructed component costs relative to inflation



Graph D: Market share for steel and concrete frames, UK multi-storey buildings.

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Setting standards within the offsite sector: The Buildoffsite Registration Scheme

Bassam Burgan, SCI Deputy Director, explains the advantages of the first offsite sector specific scheme that focuses on the safe and competent delivery of service.

Organisations behind the scheme

Buildoffsite, an industry wide campaigning organisation, promoting the UK offsite construction sector, recognised the need to establish sector specific standards as part of a wider strategy to raise the profile of the industry. It was considered that the best way to achieve this aim was to introduce

Lloyd's Register EMEA developed a scheme which focused on process but also recognised existing product QA system certification.

a registration scheme, which benchmarked members against sector best practice. A rigorous and technically well founded scheme would provide confidence to client organisations, end users, insurers and

other stakeholders that best practice was adopted in designing and constructing assets.

Lloyd's Register EMEA was chosen to develop the scheme, due to the strength of its reputation for integrity and independence, both nationally and internationally and the experience of developing and operating similar schemes in other sectors, such as utilities.

British Board of

Agrément (BBA) and the Steel Construction Institute (SCI) were approached to support the scheme operation, through the provision of technical specialist support.

About the scheme

The Buildoffsite members were concerned by the ever widening gap developing between current certification products and the demand of the market for flexibility and rapid change. The scheme was therefore required to create sufficient flexibility to bridge that gap but also to introduce coherence into the diverse product and systems certification.

To address these requirements Lloyd's Register EMEA developed a scheme which focused on process but which also recognised and took account of existing product QA system certification.

Through its emphasis on process, the scheme encapsulates not only all activities from tender submission, through award, specification, design, manufacture, delivery, construction, handover and maintenance, but also all forms of certification held by the offsite constructor.

There are four categories of registration available under the scheme:

- design
- manufacturing
- construction
- project management.

Terrapin's offsite work at the Chase Farm Mental Health Unit in Enfield contributed to their successful registration.



Risk-based assessment

The Buildoffsite scheme requires the offsite service provider to define the risks to his business/project/contract/activities and identify the required control measures to mitigate, where appropriate, those risks and ensure that those control measures are communicated and implemented as necessary through the organisation.

The focus of the assessment is on the risks to achieving best practice in the safe and competent delivery of a contractually compliant offsite service or product.

The SCI and BBA technical support

Having established the principles of the scheme, it was recognised that acknowledged sector expertise would be required to lend technical credibility to the assessment process particularly in respect of the evaluation of design competence and the design process. BBA represented a natural choice to provide technical support in the assessment of the design scope of registration as did SCI, when the principal material of construction was steel.

The organisations engaged in the delivery of the scheme are reflected in the Buildoffsite Registration Scheme logo:



Why the scheme has merit

The scheme focuses on process but also incorporates product through competency based self-certification, which provides for design variation, within controlled bounds.

The Buildoffsite Registration Scheme is the first offsite sector specific scheme that focuses on the safe and competent delivery of service or product. It represents a risk-based approach to assessment which will support the more rapid introduction of innovative offsite construction solutions.

Registration under the scheme is evidence to the market that the registrant is committed to the implementation of best practice in the delivery of products and services to the industry and therefore represents a powerful marketing tool with international, as well as national, recognition.

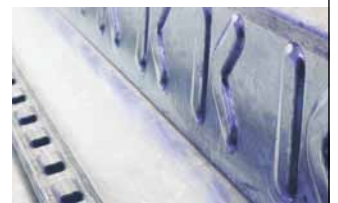
The current status of the scheme

The pilot assessment has been completed and the first Buildoffsite Registration Scheme certificate was

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Terrapin were awarded the first Buildoffsite Registration Scheme certificate. Left to right: Richard Ogden, Buildoffsite Chairman; Glen Miller-McIlravey, Terrapin Health Safety and Environment Manager; Dick Ward, UK Asset Management's Business Manager.

awarded to Terrapin Ltd at the OSC Awards Dinner on the October 30, 2007, for the scopes of design, manufacture and construction. The pilot assessment provided Lloyd's Register with the opportunity to apply the principles of the schemes, operated in other sectors, to the offsite sector and at the same time establish sector benchmarks of common, good and best practice.

The Buildoffsite Registration Scheme was

launched at the Lloyd's Register Group's London Office on the November 7, 2007 during which Nick Whitehouse, former Chairman of the Terrapin Group, said of the scheme "The Buildoffsite Registration Scheme initiative is a scheme which we believe is valuable to us, to the client and to the sector as a whole representing a vehicle for continuous improvement"

The scheme has invoked considerable interest within the offsite sector and a number of constructors and designers are progressing assessment against the scheme, with a view to gaining registration.

More information on the scheme can be found on the following website address: www.lloydsregister.co.uk/buildoffsite or alternatively you can contact Anna Whiting of Buildoffsite on Tel: +44 (0)207 549 3306 or Samantha Lee of Lloyd's Register EMEA on Tel: +44 (0)247 651 8631.

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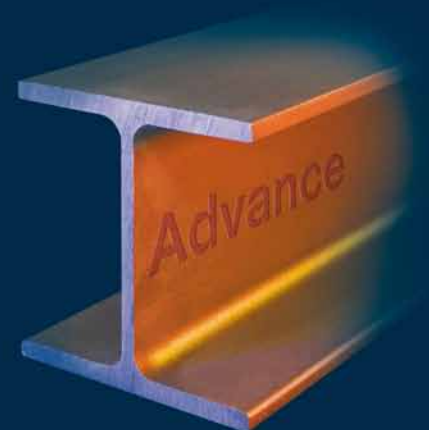
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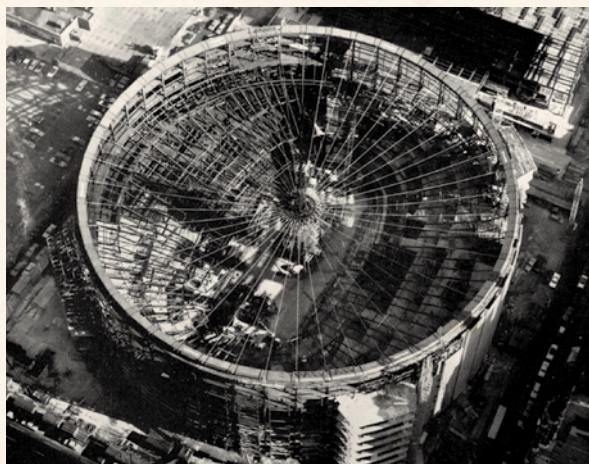
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rick. The arena floor, 45 ft above street level, is supported by heavy welded plate girders with flange site splices and 36-in wide cover plates built up and developed by connecting the plates together with high strength friction grip bolts. Roof steelwork was erected from this floor level by a truck crane equipped with a 170 ft boom and a 30 ft jib.

At roof level, on top of the perimeter columns, 48 welded box sections – each 26 ft long, 3 ft deep and 8 ft wide and made of corrosion resistant weathering steel – join to form the compression ring. From this ring the steel cables are stretched to a 100 ton, 41 ft diameter, manganese-vanadium steel tension ring composed of four field-welded sections.

Below the arena there are two levels containing a 5,000 seat amphitheatre known as the Forum, a 501 seat cinema, a Hall of Fame, a Gallery of Arts and a 48 lane bowling centre. The entire structure is faced with precast concrete panels of varying shades of brown aggregate, exposed and separated by buff coloured recessed concrete coves, illuminated at night.

The centre is part of a massive project on an 8½ acre site to be known as Pennsylvania Plaza: landscaping and open plaza area occupies 53% of the overall site. The work includes modernising and redeveloping a railway station over which the Centre is being built, so that all railway and terminal facilities are underground. This has been going on simultaneously with the erection of steelwork for the Centre.

Because the Centre complex – which also includes a 29-storey office building – straddles the rail tracks and main terminal facilities, many very large and heavy steel assemblies were required. The largest was a girder section 155 ft long, 13 ft deep and 3 ft wide weighing 96 tons and joined to two other girder sections to form the main support for the arena floor, the combined girder being 282 ft long and weighing 213 tons. Both the main section and the combined girder are believed to be the largest ever used in a building in New York City. In all, approximately 15,000 tons of steelwork were used in the foundations for the complex, built 50 ft downwards from street level to form a rectangular network covering an area of 364,000 ft, almost as large as eight football fields. All this work was done with minimum interference to train schedules and the various businesses within the terminal.

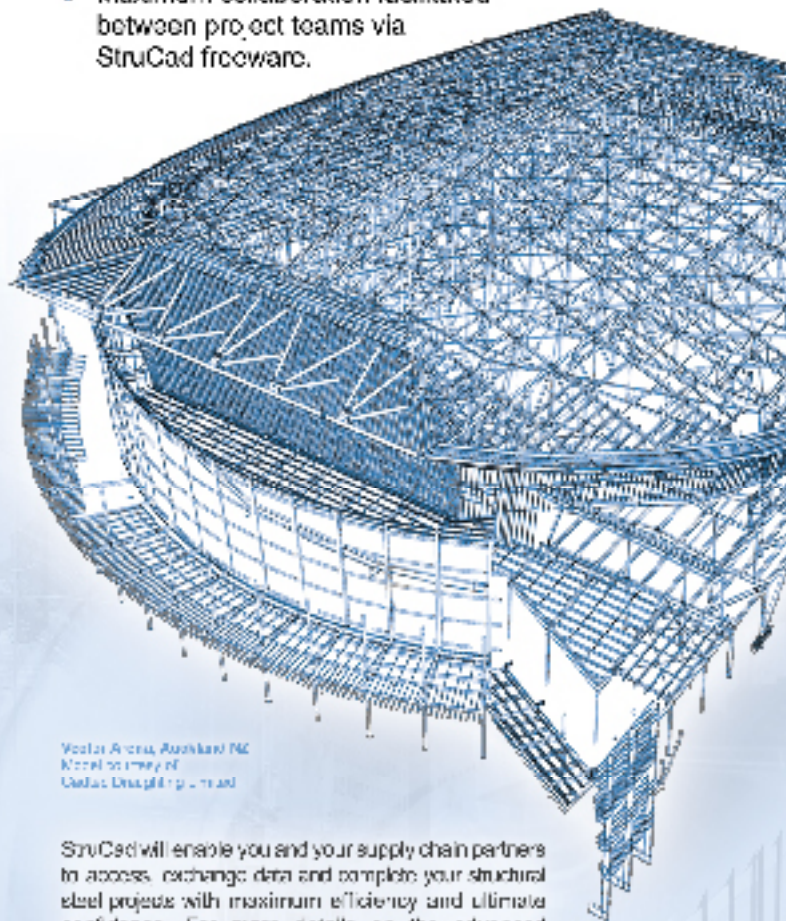
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AD 317

Use of integral crossheads in skew highway bridges

Guidance Note 1.02 in the Steel Bridge Group publication *Guidance Notes on best practice in steel bridge construction* (P185) includes advice about the use of integral crossheads at the intermediate supports of skew multi-girder deck bridges. However the advice does not discuss the structural behaviour of the deck in service or the possible need for additional bracing for the construction stage. This AD provides supplementary advice from the Steel Bridge Group to cover that deficiency.

Integral crossheads are used when it is necessary or desirable to reduce the number of intermediate columns, the typical arrangement being to position a single column between a pair of longitudinal girders and to provide a crosshead between the girders to transfer the vertical reactions. For skews greater than about 25° the Note advises that the crossheads should be square to the main girders, which would lead to the configuration shown in Figure 1 for a four-girder three-span bridge. As can be seen in the Figure, the crossheads are not continuous across the width of the bridge, they extend only between each pair of girders: there is no continuity, other than the deck slab, between the two

inner girders.

At first sight this arrangement might seem to be inadequate to resist transverse bending, with the slab spanning transversely between the columns to carry all the bending. However, for practical configurations, it has been shown that the bending of the main girder contributes to transverse load distribution, with the whole deck behaving somewhat like an orthotropic slab. There is no need for continuity of the crossheads and indeed any continuity would tend to attract fatigue loading – the detailing of the crosshead connections would thus need to consider the stress ranges due to the continuity that would exist. It is of course necessary to model the 3D behaviour of configurations such as that shown in Figure 1, particularly in relation to the transverse bending of the slab adjacent to the crossheads; a simple 2D grillage model is not adequate for that analysis.

However, if no continuity is provided at the construction stage, it becomes quite difficult to control relative deflections during concreting the deck slab unless there are other temporary supports under the girder or the bearing provides rotational restraint - in

effect each pair of girders would rotate about a longitudinal axis. For construction purposes, if rotation restraint is not provided by the bearing or by temporary works between the girder and the pier top it may be beneficial to introduce bracing between the inner girders at the crosshead positions (either triangulated bracing or beams with stiff connections to the main girders), as shown in Figure 2 (the intermediate bracing is now aligned with this additional bracing). Such provision also controls the transverse spacing between the inner girders; this provision is especially important where precast plank permanent formwork is used. This extra bracing does not need to be as substantial as the crosshead beams. If the bracing is more flexible than the crossheads, and does not act compositely with the slab, it may be acceptable to leave it in place (thus avoiding the potentially hazardous operation of removal), provided that the fatigue consequences are assessed and found to be acceptable. If the fatigue consequences are not acceptable, the bracing will have to be removed.

Since the need for this continuity bracing depends on the construction operations, the

provision of such bracing should be discussed between the principal contractor and the designer at an early stage so that agreement can be reached about what should be provided and whether it must be removed after construction. Early involvement of the steelwork contractor will also assist in ensuring that any additional steelwork can be incorporated efficiently with minimum disruption to the fabrication process. The cost and responsibility for the additional steelwork should also be established at an early stage.

Where the skew is small (and where the supports are square to the main girders), the provision of continuity (with the webs of both crossheads and the continuity bracing in a common plane) is less onerous in fatigue. There is however still the option for either the permanent works designer or the contractor to provide this bracing. In the latter case, the bracing would probably be designed to be left in place, rather than removed after construction.

Contact: David Iles

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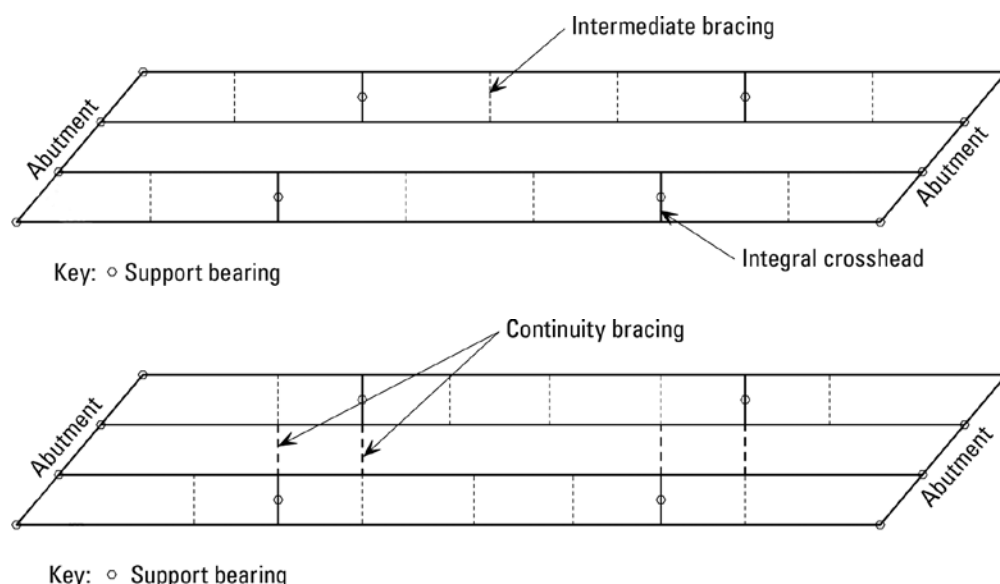


Figure 1.
Arrangement of main girders and crosshead girders for a skew multi-girder bridge

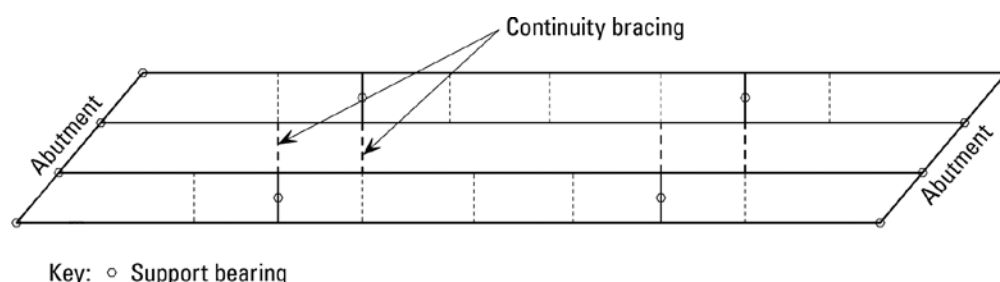
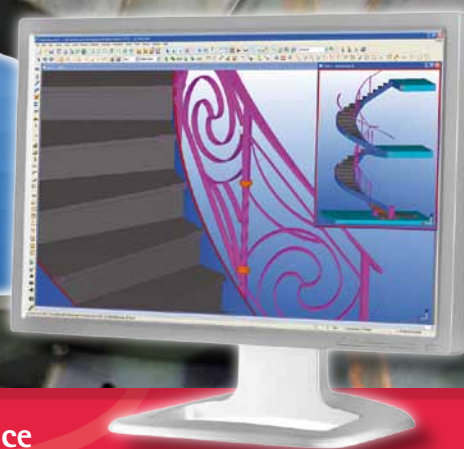


Figure 2
Provision of cross beams for the construction stage

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