OCTOBER 2006 VOL14 NO9

NSC

NEW STEEL CONSTRUCTION

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Athletics stadium for Lee Valley

The SCI Annual Dinner

16th November 2006

The Landmark London,
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SCI's prestigious Annual Dinner is always an excellent opportunity for networking while enjoying congenial company, savouring good wine and exquisite food.

The annual dinner will start at 7pm with a pre-dinner drinks reception in the Drawing Room, followed by dinner in the Ball Room.

The SCI are honoured to have Barry Cryer as this year's guest speaker

Dress Code: Black Tie

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Cover Image
LEE VALLEY ATHLETICS CENTRE
Client: Lee Valley Regional Park Authority
Architect: David Morley Architects
Structural Engineer: Buro Happold
Steelwork Contractor: SH Structures

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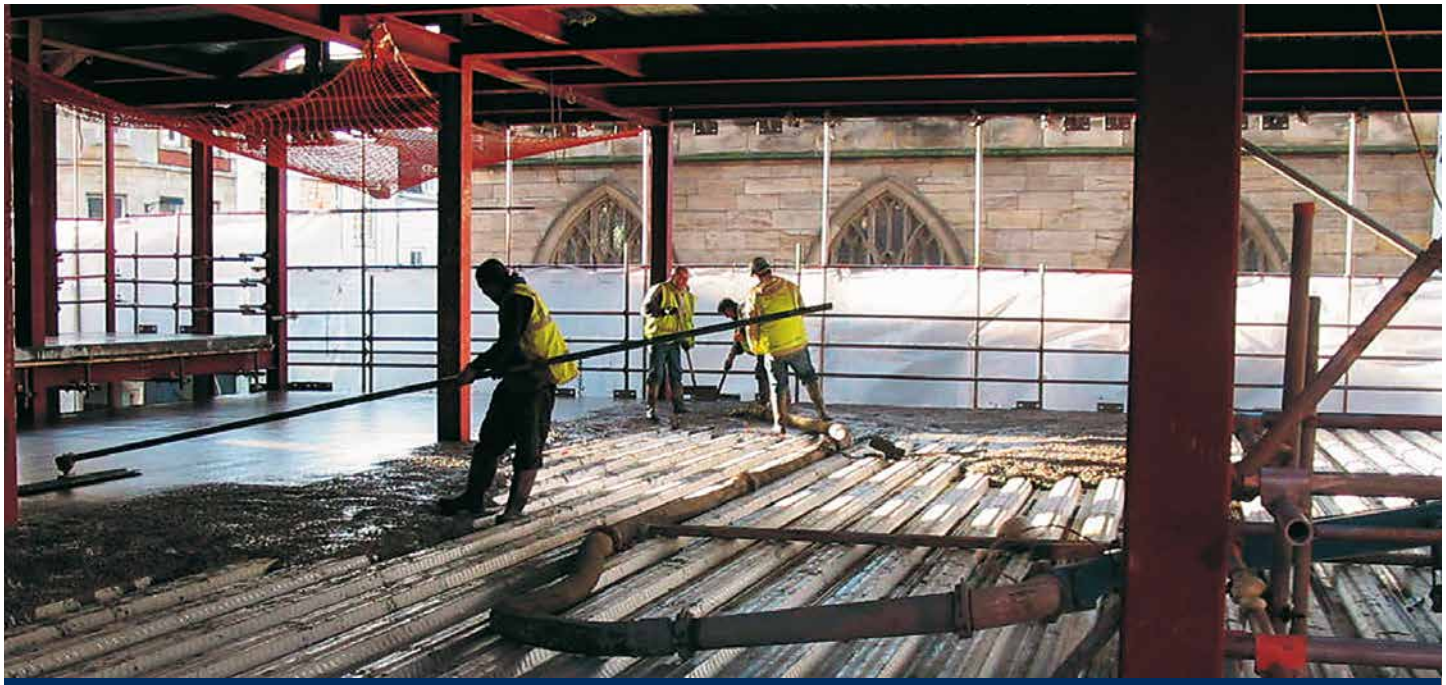

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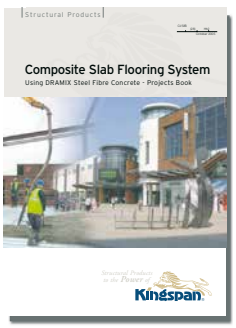

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Advance spells sustainable quality assured product

Nick Barrett - Editor

A new name for structural steel sections entered the UK market in September, when Corus renamed its entire UK market range as Advance (see News). New section sizes have also been introduced to increase the flexibility offered to designers in steel. The new system of section designations and grade specification will soon become familiar to all who are specifying a sustainable and quality assured products. All Corus sections will have the Advance brand rolled into the web, making for swift and easy identification.

This is much more than a mere name change. Since September all structural sections and plates used anywhere in the European Community have to comply with the Construction Products Directive, so designers need to be sure that the sections they specify meet these requirements. Choosing a CE marked product is the simplest way of complying, and perhaps the easiest way to guarantee this is now to specify Advance from Corus, which was the first steelmaker in the world to gain approval to CE mark its structural sections and plates.

To support this new identity and to show its continued commitment to the UK Corus is also investing heavily at both its Advance section mills, at Teesside and Scunthorpe, to help sustain its advanced position in steel construction.

It used to be said that nobody ever lost their job by specifying IBM, in the future the same might be said of specifying Advance from Corus.

Shaking out an old myth

It is always good to see a myth overturned, especially when blindly accepting it is doing damage to the performance of a key institution like the National Health Service. The myth that has now been laid to rest is the one about the vibration performance of floors in steel framed buildings. For years it was put about by proponents of other framing materials that steel could only meet the onerous vibration requirements of the National Health Service for hospitals by using uneconomically heavy sections. The steel sector consequently made little headway in this sector of the market, but such progress was being made elsewhere that it was largely allowed to go by the board.

Now that the UK is replacing its often outdated healthcare buildings it has become important for the country to have the most efficient and economic building solutions available. So the industry took another look at the actual performance of floors in steel framed buildings, and was pleasantly surprised to find that in fact a building with normally dimensioned steel sections – those familiar to any office building for example – could easily meet the NHS requirements, and with room to spare.

New research from the Steel Construction Institute based on extensive testing of real floors provides the guidance that designers need to produce all floor and building types that meet serviceability performance requirements of the most demanding of clients. Hospital operators in both the private and public sectors have declared themselves happy with the vibration performance of floors in their steel framed healthcare facilities, and occupants of properly designed and constructed luxury apartments feel the same. The vibration myth has been well and truly shaken out.

Advance with Corus

Corus has given a new identity to its structural sections range to make it easier to specify CE marked sections compliant with the EU Directive of Construction Products (CPD). The new brand name is Advance which will be rolled into all Corus sections.

The Corus Advance sections range has been expanded with 21 new beams and columns added to the 'traditional' UK section range (see article on page 14). This increases the flexibility offered to designers to achieve the most effective structural solution.

Corus Construction and Industrial General Manager Alan Todd said:'The key driver behind the new brand is the requirement from September 2006 for structural sections used in Europe to comply with the CPD, and the simplest way for designers to ensure that they are specifying compliant sections is to specify those that are CE marked, as Advance sections are. The Advance range covers all sections types and all of them will have Advance rolled into the web.'

Manufacturing excellence is assured for steel with the Advance sections mark. Advance sections were the world's first to be accredited under the onerous Lloyds Register marine quality scheme, and Corus is one of a very small number of manufacturers outside Japan to carry approvals from the Japanese Institute for Standardisation.

Corus was the world's first steelmaker to gain approval to CE mark its structural sections and plates to meet the EU directive on Construction Products (CPD). Corus' process quality is underpinned by an approval record that is second to none and it is continually investing to maintain its leading position.

A free brochure with a CD detailing blue book properties is available from Corus at www.advancesections.com.

Multi-million pound steel development

The £330M redevelopment of the Westfield Derby shopping centre is forging ahead and will eventually require more than 11,500t of structural steelwork.

The overall project consists of a major refurbishment of the existing Centre and the construction of a new build section which will include more than 100 shops and two large anchor department stores, a 12-screen cinema complex and a variety of restaurants and cafes.

Steve Dobbs, Project Director for steelwork contractor Rowen Structures said the majority of steel erection in the new build section should be complete by the end of October.

"The new part of the shopping centre will directly connect into the existing centre," he said. "Our steel erection has mostly involved installing beams, columns and heavy trusses."

The project owner, developer and main contractor is Westfield Shoppingtowns.

Due to open in late 2007, Westfield Derby will provide more than one million square feet of new and upgraded retail space.

Pictorial scheme will improve site safety

The SCI in collaboration with the Health and Safety Executive (HSE) has completed its year-long research project known as Trojan Horse Messaging, a technique that conveys vital health and safety information on construction sites through pictures at point of use.

The idea of the pictorial element is that it will overcome language barriers while communicating safety information to construction workers from various backgrounds.

Margaret Burns, an HSE Commissioner said she was confident that the technique will lead to real benefits in reducing risks on construction sites.

The Trojan Horse Messaging technique can be used as part of a health and safety strategy to deliver a safer working environment.

"This is another good example of a successful working partnership within the construction industry," Margaret Burns added.

A number of major contractors participated in this study, including Skanska, Taylor-Woodrow, Multiplex, Bovis, Mace and William Hare.

"The technique definitely made a difference. It's a new tool that can be used to influence workers' actions on construction sites as it delivers key messages to operatives without direct management intervention," said Steve Derbyshire, Acting Head of Health and Safety for Taylor-Woodrow.

Bassam Burgan, Deputy Director for SCI commented: "I am delighted the SCI led this project and contributed to the HSE's efforts in building a better and safer environment in construction."

New guide enables high-quality performance of steel framed floors

The SCI is about to publish a revised version of its design guide on the vibration of floors.

Commonly referred to as P076, the guide was first published in 1989 and since then it has been widely used and its advice has generally stood the test of time.

However, vibration performance is now a major factor in building design, particularly with the use of lightweight composite floors, and the guidance needed to be updated.

The Second Edition offers the most up-to-date information on determining performance and appropriate acceptance criteria. The guidance has made reference to tests on a variety of real buildings - tests which dispel the myth that steel-framed floors don't meet the appropriate performance standards.

A pre-publication draft of the publication was launched at the recent Corus hospitals seminar held in Durham on the 25 September and all those attending the London Corus hospitals seminar on 5 October will also receive a copy of the guide.

Paul Devine of the SCI said: "The guide provides design guidance for all floor and building types which use a structural steel frame. We've brought together all current information on vibration into one new Edition."

Explanations within the publication include the different types of excitation produced by occupant-induced vibration, while a simple design procedure is featured which shows how to calculate the floor acceleration, weight it to reflect human perception and compare it with the acceptance levels.

The Second Edition, which is available for purchase from the end of October, was prepared by Dr Stephen Hicks and Paul Devine of the SCI.

Atlas Ward scores a hat-trick

The third distribution project to be undertaken by Atlas Ward Structures for main contractor Winvic and industrial developer ProLogis in Kettering is underway.

The latest structure, being built on a speculative basis, is 256m wide and consists of eight 32m wide spans, and is 138m-long with 17 bays each measuring 8.1m.

Atlas Ward has designed, fabricated and is erecting more than 1,000t of hot rolled structural steelwork for the project and 250t of cold rolled steel.

Vance Lamb, Project Designer for Atlas Ward said in order to create a larger open span area within the warehouse every alternate internal column was omitted. "We used UB longitudinal girders to support the rafters where the columns have been omitted," Mr Lamb explained.

Offering a clear internal height of 12m, the structure also features two steel framed bolt-on office blocks along one elevation.

Mr Lamb said the smallest block, known as a 'hub' office is a 12.5m long x 8m wide two storey building which will be used to monitor truck movements. The other office will function as the main administration block and is a three-storey building measuring 31m x 20m.

Atlas Ward has now erected more than 4,500t of steelwork for three buildings on the ProLogis Park in Kettering.

Conder goes to Cumbria

More than 2,000t of structural steelwork has been supplied by Conder Structures for a major redevelopment in Workington town centre.

The new £45M scheme in the Cumbrian town is known as Washington Square, and main contractor Thomas Armstrong Construction has built the project on the site of a former car park and supermarket.

It is arranged in four zones around a piazza-style town centre, and the centrepiece of the project is a steel-framed three-storey 8,450m^2 Debenhams store.

Gordon Ridley, Managing Director of Conder said the company had supplied mainly beam and stick steelwork for the retail parts of the project.

"Our steelwork has reconfigured the former town centre into 25,000m^2 of good quality shopping in 50 units," Mr Ridley said.

Town centre parking will be increased by 50% with a Conder designed and erected steel-framed three-level car park.

Conder said the freestanding steel car park was erected in a 17-week programme.

AROUND THE PRESS

Construction News
31 August 2006
World Steel output up
Figures released by the International Iron and Steel Institute revealed that production in the European Union reached almost 16m/t during July this year, up almost 11% on July 2005 volumes.

Construction News
14 September 2006
Safety focus
The Trojan Horse Messaging study - led by the Steel Construction Institute and sponsored by the HSE - used basic images to increase safety awareness. HSE Chair, Bill Callaghan said: "This novel messaging technique can instigate positive behavioral change in site operatives."

Construction News
21 September 2006
Motorway safety
Corus Tubes have developed a steel crash barrier that could rival concrete barriers. Its Protect 365 system meets all the requirements for crash barrier design codes EN 1317 and will do the same job as other systems.

European Foundations
Autumn 2006
Life after death
Steel's sustainability was recently demonstrated on a building site in Chelsea, West London. "Steel piles are quick and easy to get out of the ground and if they can't be reused they can always be recycled."

Contract Journal
6 September 2006
Robots on track
"Timing is critical on this project, by using robotic welding, we are able to fabricate the girders faster and have confidence that the finished product will be right first time."

The Independent
19 September 2006
Birds nest takes shape
A major milestone in the construction of the showpiece stadium for the 2008 Olympics in China was reached this week when the interlocking steel superstructure that gives the arena it's 'Bird's Nest' shape was freed of its supports.

Training for paint applicators to be compulsory

All paint applicators, whether site or factory based, will be required to undertake a new training programme from next year for the painting of all steelwork to be used on infrastructure projects.

The new requirements will be implemented during 2007, and will become compulsory by the end of January 2008 for contracts to be undertaken for the Highways Agency, Network Rail, Welsh Assembly, local authorities and other clients.

Dr Derek Tordoff, BCSA Director General, said it was client driven and is aimed to improve the performance of paint coatings on steelwork.

"It will become a compulsory requirement on all infrastructure projects," he added. Painting will have to be done by trained applicators supervised by a painting coordinator under an audited quality management system.

The Register of Qualified Steelwork Contractors (RQSC) Scheme is in the process of introducing this new requirement for companies registered to undertake bridgework. The Industrial Coatings Applicator Training and Certification Scheme (ICATS) is organised by the Institute of Corrosion.

World steel output up for August

The International Iron and Steel Institute (IISI) reported that world steel production during August stood at 101M/t, 11% up on the same period in 2005.

Of the 62 countries that report to the IISI, China was by far the largest single producer, accounting for 36% of world production, up 2% on last year's figures.

Germany was again the largest steel producer in the European Union with a total production of 3.9M/t in August, up an encouraging 16% on figures for the same month in 2005.

European steel production is dominated by five major countries, Germany, the UK, France, Spain and Italy.

Geoffrey Taylor, Marketing Director of Caunton Engineering and Editor of the European Convention for Constructional Steelwork (ECCS) annual statistical bulletin said the European market for 2005 was generally up, and the German decline in demand, though still decreasing, is beginning to level out.

"A recovery in Germany should be good news for all European steelwork companies," Mr Taylor said.

The statistical bulletin was presented at the ECCS annual convention held in Romania at the end of September as NSC was going to press.

A full European market statistical breakdown will appear in the November/December issue.

Steel tops Forth tolls

Cairnhill Structures has recently completed the erection of a new steel canopy over the eight toll booths serving the Forth Road Bridge in Scotland.

The canopy is 41.5m long x 17.5m wide and is supported on eight steel 500mm x 300mm x 16 RHS columns. The structure is triangular in cross section and was constructed with 80t of steelwork.

Inside the canopy there is a hollow area containing a maintenance walkway and feature coloured lighting to illuminate the structure through its Expanded aluminium soffit and skewed wall cladding.

The steel consists of angle section rafters and internals supported on a grillage comprising 610mm x 305mm x 149mm UB primary and 610mm x 225mm x 101mm UB secondary beams.

Jack Sanderson, Cairnhill's Managing Director said the project presented a number of challenges, not least the fact that the bridge couldn't be closed during the four-month steel erection programme.

"Traffic management was in place and we were allowed to close only three booths at any one time," Mr Sanderson said. "All steel brought on to site had to be erected immediately as nothing was allowed to be left stockpiled on the bridge," he added.

Strong winds are not uncommon along the Forth and consequently the canopy was designed with a north facing sloping top to deflect the wind.

All canopy steelwork is galvanised to protect the structure from windborne salt which causes rust. And, as Mr Sanderson pointed out, "This means it won't have to be continually repainted, unlike the bridge."

Major investment rolled out by Metsec

Metsec has announced an £8.5M investment programme in its engineering division which will create up to 40 new jobs at its Oldbury, West Midlands plant.

Coinciding with the company's 75th anniversary celebrations, the investment includes a new rolling mill for its framing division.

The £750,000 Bradbury mill has been installed to meet increased demand, further reduce lead times for its light gauge galvanised steel framing systems and increase its rolling capabilities.

Erle Andrews, Director of Metsec's Structures Division said the new mill will provide more flexibility and allow orders of differing sizes to be processed easily giving better throughput.

"This is our fourth dedicated rolling mill for the division," Mr Andrews said. "We are experiencing year-on-year 20% growth since we started production in 1994 and last year the framing division produced 12,000t," he added.

The new mill will enable the business to produce 70mm section, pierced and in any length. Metsec is now able to manufacture and deliver 70mm to 200mm stud and track sections.

Left to right: Stephen Tilsley, Metsec Managing Director; Wolfgang Spreitzer, Metsec Chairman; Erle Andrews, Director of Metsec's Structures Division; Sir Digby Jones, former Director General of the CBI.

Commissioning the mill last month, former Director General of the CBI, Sir Digby Jones said: "Metsec is a shining example of the best of modern British manufacturing. It has delivered excellent customer service through continuous investment."

Another aspect of the company's investment is a £3M quick changeover rolling mill with pre-piercing capability for its Custom Roll Forming division.

Metsec Managing Director, Stephen Tilsley commented: "We have expanded and reorganised our main site, built an additional manufacturing centre and installed state-of-the-art equipment. This will also ensure we continue to be market leaders in the future."

Corus promotes Advance at Civils

The Corus stand at Civils 2005

One of the main themes of the Corus stand at this year's Civils exhibition will be the introduction of Advance - the new name for structural sections.

Jill Southward, Marketing Communications Manager for Corus Construction & Industrial said customers who will benefit the most from the launch of Advance sections will be present at the show and it was a perfect opportunity to make the industry aware.

In addition to Advance, the Corus stand will also feature displays and information on many other Corus construction products and services, including high containment bridge parapets, Corefast lift cores and new developments in floor decking and cladding.

Civils runs from 28-30 November at London's Olympia.

NEWS IN BRIEF

Seven managers from companies including Corus and Metsec who are participating in the **Metals Industry Managing for Success** pilot programme have recently completed their NVQ level 4 in management. This newly designated NVQ plays an integral part in the programme, which focusses on the long-term benefits individual training and company orientated projects can have on business development.

CSC's new integration tools within its Fastrak Building Designer and 3D+ have been developed with the flexibility to allow engineers and technicians to choose a design and CAD process that best suits their needs. When models are merged, all the proposed amendments are reported to the user without compromising any existing data.

FBEAM 2006, the new design software package from **Fabsec**, was launched in September. It gives structural engineers a new project capability to manage beams collectively, while an edit function permits the rapid design and modification of multiple members.

Dr Derek Tordoff's two-year tenure as Chairman of the **Metals Forum** has come to an end. "I would like to thank the members for the confidence they showed in electing me as their first Chairman," he said.

The **Eurometal Steel Net Forum 2006** will take place on 13 October 2006 at the Motorcycle Museum, Solihull, Birmingham. The NASS Steel Industry Dinner will be held on the preceding evening at the Birmingham Hilton Metropole Hotel. For more information on both events fax: 0121 236 7444.

A 21st Century steel reinterpretation of an **ancient Egyptian pyramid** opened in August in Kazakhstan. Known as the Palace of Peace and Reconciliation, the £37M building was built in 18 months and Buro Happold was structural engineer.

New water based intumescent coating

Leighs Paints has launched a new water based intumescent coating for on site use known as FX5002.

This latest addition to the company's Firetex range is said to have noticeably lower loadings and European certificate (EN13381).

In the event of a fire, FX5002 reacts and produces a thick foam coating that insulates the steel frames of buildings, giving people ample time to evacuate.

Bob Glendenning, Leighs Paints Manager for Fire Protection said the product is expected to take a significant share of the market for materials applied on site where safe working is clearly aided by the water based nature of this coating.

"It's also user friendly as it is TCEP-free," Mr Glendenning said. "Many water based products do contain this carcinogenic substance," he added.

Good performance improvements can also be seen as the low film thicknesses can achieve required fire ratings.

Caunton supplies the data

More than 1,600t of structural steelwork has been supplied and erected by Caunton Engineering for a new data centre in Basingstoke, Hampshire for leading investment bank JP Morgan.

The steel framed structure covers an area of 15,000m^2 and has largely been constructed with 16.8m long 686 UB beams and 254 x 254 UC columns which were all pre-coated with intumescent paint off-site.

A lightweight steel framed roof is supported over the structure covering a concrete roof, which was erected as a safeguard for watertightness.

Gary Hatton, Caunton's Contracts Manager said the main steel erection was completed in five weeks by a team directly employed by Caunton.

"Steelwork erection commenced on site eight weeks after the award of contract, within this period there was a 2-3 week period allowed for intumescent coating the steelwork off site," Mr Hatton said.

Consequently, Caunton Engineering played a major role in coordinating the steelwork design team and interfacing trade contractors.

Station gets special treatment

Bourne Special Projects (BSP), part of Bourne Steel, erected the pedestrian bridge at the new Shepherds Bush railway station in one overnight possession in August.

The 40m-long 45t steel structure was lifted into place by a 400t mobile crane and the whole procedure was completed in three hours.

Howard Cox, BSP Division Director said: "We had two teams working simultaneously, one constructed the supporting frame for the bridge and the other assembled the bridge on an adjacent site, all operations being close to the live railway."

"The frame dimensions required extensive fine tolerance surveying prior to the lift as the bridge had to fit exactly," Mr Cox added. "We only had a short possession period to install the bridge but careful planning enabled us to complete the job allowing the railway to reopen on time."

Working on behalf of main contractor Norwest Holst, the entire contract was worth £450,000 and lasted ten weeks in total. BSP said it used approximately 110t of hot rolled steel for the job.

The new Shepherds Bush railway station is on the West London Line and will provide access to the major White City retail and residential development.

"Tekla Structures has made my job more enjoyable...we have generated only positive feedback."
David Hughes, Kendrew Metalwork Ltd.

"At the end of the day, your 3D model will most probably end up in Tekla Structures, so why not start with it!"
Ray Young, Arup.

"We like to use Tekla Structures for everything we can on every job...it has helped us speed up all of our processes!"
David Poole, SH Structures Ltd.

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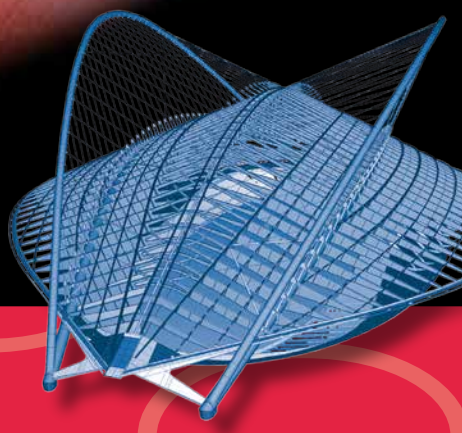

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The flat pack thoughts of Chairman Manning

Arup director Martin Manning is set to take over as chairman of the Steel Construction Institute next month. Here he talks to Ty Byrd about life, engineering philosophy and the IKEA approach to assembly.

Just what would they come up with, the guys at flat pack furniture specialist IKEA, if they turned their thought processes to major steel structures? The question is lightly pondered by Martin Manning, one of Britain's leading designers of innovative steel roofs and buildings, in looking to the future. He believes there are possibilities for creating structures which have not yet really been investigated, particularly in terms of metallurgy and casting. Applying a little IKEA-like thinking in these areas, with the encouragement of supportive clients, could well result in the creation of new opportunities for the steel construction industry to exploit. To everyone's benefit, he says.

"There is no conventional wisdom: everything has to be examined and then you make up your own mind."

Martin Manning's knowledge and opinions are held in high esteem. They are two of the reasons why, having served on the Steel Construction Institute's Executive and Council, he is likely to be appointed chairman, with effect from 16 November 2006. He will follow in the footsteps of Arup colleague Peter Head (see box) and will ensure due governance of the SCI for at least the next three years. The role is strictly part time, however. He remains a hard working director of Arup, as ever continuing to lead big projects.

For this article, he was interviewed having just stepped off the plane from Abu Dhabi, where he is project leader for the new airport terminal, due in 2010. Terminals and stations are a definite speciality: a project just emerging from under his wing is the new terminal and railway station at Beijing Capital International Airport, nearing completion for the 2008 Olympic Games. Prior to this, he led the design team for the redevelopment of London's Blackfriars station. And before that, he was engineering design leader on (in no particular order) Zurich's Flughafenkopf, the terminal building at Chek Lap Kok in Hong Kong, the terminal at Munster Osnabruck and Stansted Airport's terminal building.

So, a civil and structural engineer with impeccable credentials, since the early 1980s gained mainly working in steel. It was then he moved from other materials to designing one of that decades most iconic steelwork buildings, the cable stayed Renault Distribution Centre in Swindon, of which more later. He was told he was to do the structure by Jack Zunz, the legendary Arup partner, who had been in conversation with the building's architect Norman Foster. (Jack Zunz had a habit of telling Martin Manning what to do. An outstanding mathematics scholar, Martin had read the Mechanical Sciences Tripos and was considering a PhD, a matter he mentioned to Jack, who was a visiting lecturer at the university. "No, you're not doing that," said Jack, "you're coming to work for me." He has been with Arup ever since.)

Jack Zunz had a clear view that Martin Manning was the right person for the Renault job, despite what constituted a fundamental change in structural medium for the younger man. Having had an Arup grounding in basic engineering at home and overseas, including postings in Africa and Iran, Martin had spent the half dozen or so years before starting the Renault building working in the special structures group for a project in Saudi Arabia. There his eyes had been opened by Frei Otto, the German engineer/architect renowned for his tensile and pneumatic structures. "To Frei Otto, there is no conventional wisdom: everything has to be examined and then you make up your own mind about it. You invent everything from your own understanding of what is going on. You do not merely reproduce best practice but design from first principles," says Martin Manning. Frei Otto was – is – a hugely influential man, with disciples rather than colleagues. "Before him, I had been a compliant believer in codes of practice. I changed completely."

He worked on the Frei Otto structures – intended to be parliamentary buildings in Riyadh – at Arup under Peter Rice, another inspirational engineer who was completely at ease with Otto's philosophy. It was an extraordinary time, with Arup doing extraordinary things, around the world. Peter Rice had teamed up with the Italian Renzo Piano and this brought further challenges to the same special structures group. One was working for Giovanni

The Steel Construction Institute is governed by a Council and Executive Committee – the Council determining overall strategy and direction; the "Exec" acting more like a board of governors or trustees, ensuring the institute is run on business like lines as effectively as possible.

The Chairman, drawn from Council, is the titular head of SCI, provides advice and guidance and is invested with certain powers to ensure due governance. "I hope I never give him cause to," says Dr Graham Owens, SCI Director who heads the permanent staff of 60, "but he could dismiss me if I misbehave!"

The Chairmain remains in post for three years with a one year option beyond that. Past chairmen have been Bernard Wex of Freeman Fox and Partners, Gordon Sambrook of British Steel, Arup's Richard Harryott, Surrey University's Patrick Dowling and Peter Head, formerly of FaberMaunsell, latterly of Arup.

Arup

Renault Warehouse, Swindon

Agnelli of Fiat who wanted a new way of designing and assembling motor cars. "We came up with a steel frame optimised for strength, stiffness, lightness and stability, to which plastic panels could be added, to allow styling to be varied more readily than with steel panels." They found VW had arrived at the same solution two years earlier, only to have abandoned the concept having been thwarted by industrial interest.

Then, for Martin Manning, came the Renault Distribution Centre. This was to reinforce his commitment to working from first principles rather than rely on empirical rules. The Renault warehouse was a seminal structure in its day, and still is an outstanding building. The support comes from outside, with 24m clear spans maximising usable space but minimising volume. The building measures 96m by 388m and represented massively good value for its client, not just in material terms but in publicity too. So unusual was it that the warehouse appeared in a James Bond film, pleasing Renault no end. And the automotive connection did not end with the client: Martin Manning drew on the motor industry when picking materials for his structure. Key components are made from SGI – spheroidal graphitic cast iron – a ductile and extremely castable material known to car makers but not normally associated with buildings. Its first bespoke use was probably here.

The Renault warehouse was a seminal building in its day, and still is an outstanding building.

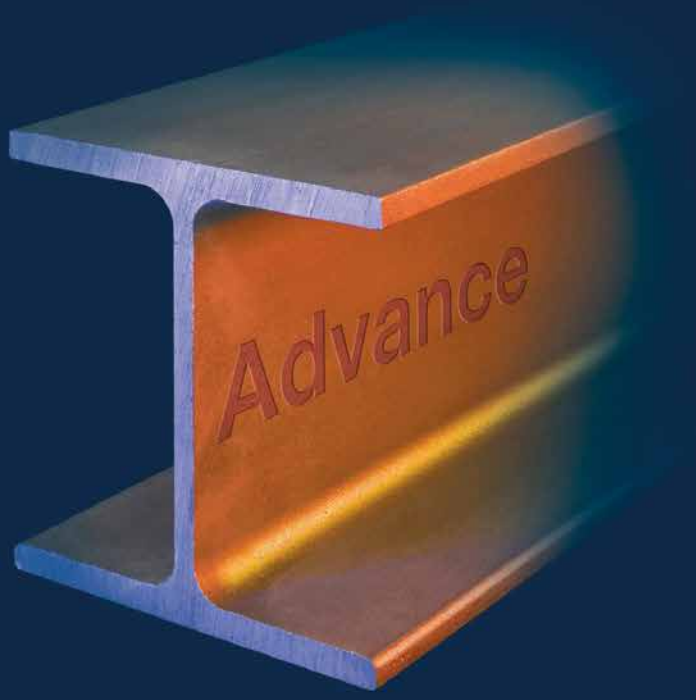
He was highly fortunate – as have been many other engineers his age, apparently – by associating with John Hurst and Keith Ford of steelwork contractor Tubeworkers, who effectively taught him about steel engineering. "Also, John did not take advantage when we made mistakes. He was a contractor that engineers and architects – including Foster, Rogers and Grimshaw – enjoyed working with because of his abilities." No surprise then, that when the same team of individuals from Arup, Foster and Tubeworkers worked on the Stansted Airport terminal, the structure went well and the client BAA ended up pleased.

The Stansted terminal defined a whole series of structures which Arup and Martin Manning subsequently became involved with – see paragraph three above for some of them. "I enjoy working in steel, I am attracted to steel, because of the possibilities for structural development. The metallurgy appeals to me as do the possibility with castings, which can prove an interesting way to go," he says.

He has strong views on the way ahead, for the industry as a whole and perhaps for the SCI in particular. Sustainability, vibration, fire and damage have been the subject of much good examination but a clearer understanding of these issues is still required. "We have a way to go," he says. "Steel materials must still hold huge opportunities that we haven't started to exploit." Life for Martin Manning continues to be far from dull.

Chek Lap Kok Airport, Hong Kong

Arup



Corus on the Advance

Corus was the first steelmaker in the world to gain approval to CE mark its structural sections and plates to meet the EU directive on Construction Products (CPD). Now, to make it even easier to specify Corus CE marked sections compliant with the directive, Corus has introduced a new name for its entire range, as Nick Barrett reports.

The new name for the Corus range of structural sections is Advance, which reflects many new technological improvements and the well-established world-class processes of this major manufacturer.

Corus is the leading supplier of steel sections to the UK market, but they offer much more than just a supply of steel. Behind the delivery of a quality assured product manufactured in controlled factory conditions is an in depth back up service giving designers and specifiers access to technical support and the benefit of a continued large research and development effort.

The key driver for introducing Advance is the requirement from September 2006 for structural sections used in Europe to comply with the CPD. Designers need to be sure that sections they specify comply, and choosing a CE marked product is the simplest way to achieve this. The new Advance name covers all section types (channels, angles and bearing piles as well as beams and columns) and they will all have the Advance mark rolled into the web for ease of identification and traceability.

In addition Corus has added 21 new beams and columns to the 'traditional' UK section range to increase the flexibility that steel offers designers to achieve the most effective structural solution. Increasingly a least weight structural design approach does not necessarily mean least cost in whole building terms. Often, structural depth has a major impact on overall cost due to the high cost of the building envelope. Where services are to be integrated with the structure, a beam sized specifically for the passage of those services is often appropriate.

21 new beams and columns have been added to the range.

New Advance™ Beams	
610x178 UKB 100kg/m	533x165 UKB 85kg/m
610x178 UKB 92kg/m	533x165 UKB 74kg/m
610x178 UKB 82kg/m	533x165 UKB 66kg/m
533x312 UKB 272kg/m	457x191 UKB 161kg/m
533x312 UKB 219kg/m	457x191 UKB 133kg/m
533x312 UKB 182kg/m	457x191 UKB 106kg/m
533x312 UKB 150kg/m	406x178 UKB 85kg/m
533x210 UKB 138kg/m	406x140 UKB 53kg/m

New Advance™ Columns
203x203 UKC 127kg/m
203x203 UKC 113kg/m
203x203 UKC 100kg/m
152x152 UKC 51kg/m
152x152 UKC 44kg/m

Advance sections were the world's first to be accredited under the onerous Lloyds Register marine quality scheme.

The UK understands the benefits of steel construction more than other countries, and this creates a level of demand that makes the market attractive to imports. Alan Todd, General Manager at Corus Construction and Industrial explains: 'Some people automatically assume that when they buy steel in the UK they are buying Corus steel, but that isn't necessarily the case. Proper certification of products to be used in construction is becoming increasingly important, using steel whose origins are in doubt could be a very expensive mistake.

'Our process quality is underpinned by an approval record that is second to none, including Lloyds register, CE marking and JIS. If your job depends on getting high quality properly certified steel then you should specify Advance sections.'

Manufacturing excellence is assured for steel with the Advance sections mark. Advance sections

What is new?

New identity
Advance is the new name for structural sections from Corus. The new name applies to all sections Corus manufactures for the UK market, including beams, columns, channels, angles and bearing piles.

New section sizes
21 new beam and column sizes have been added to the standard UK section range to better reflect modern design practice.

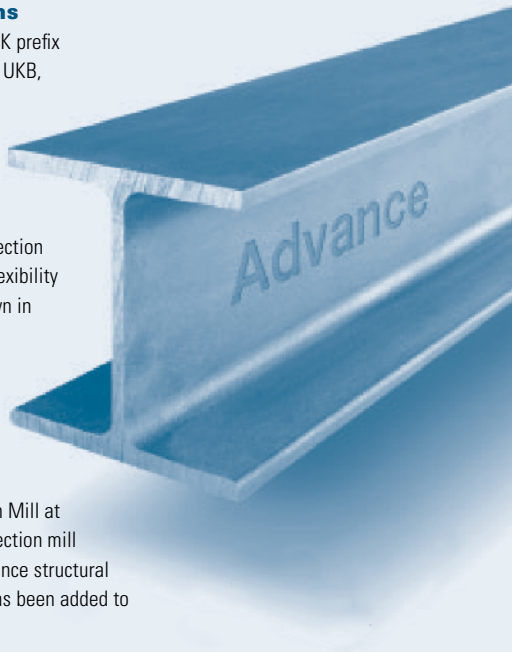
Easy compliance with the Construction Products Directive (CPD)
From September 2006, all structural sections and plates used in the UK and the rest of Europe must comply with the CPD. All Advance sections will carry the CE mark. Specifying Advance from Corus is the simplest way to guarantee that CE marked sections in compliance with the CPD will be supplied.

New method of specification
Specifying sections to EN10025 is not enough to guarantee compliance with CPD. Therefore, Corus has introduced a simplified naming protocol for its CE marked Advance sections. For example, EN10025: Part 2: 2004 – S275JR becomes Advance275JR.

New system of section designations
Advance sections will carry new designations. A UK prefix has been applied to all section types. UB becomes UKB, UC becomes UKC, PFC becomes UKPFC and angles are now UKA.

Bespoke section sizes
Corus section mills are state-of-the-art computer-controlled facilities, which can produce bespoke section sizes not included in the standard range. Similar flexibility exists to roll to tighter tolerances than are set down in national standards.

Investment in the UK steel construction industry
Corus is investing heavily at its Advance section mills to maintain its world leading position in steel construction. The Medium Section Mill at Scunthorpe is now the world's only dual rail and section mill resulting in a new level of product quality for Advance structural sections. A new Automated Distribution Centre has been added to the mill to store up to 17,000t of Advance.
For more information visit www.advancesections.com



were the world's first to be accredited under the onerous Lloyds Register marine quality scheme, and Corus is one of a very small number of manufacturers outside Japan to carry approvals from the Japanese Institute for Standardisation.

Corus has recently been investing heavily in its plant and delivery systems. Over £200M of improvements have been made at its Scunthorpe and Teesside long products' sites. This includes installing the latest in steel rolling technology at the Medium Section Mill to create the world's first dual rail and structural sections rolling mill.

Investments include construction of a new world class Automated Distribution Centre at Scunthorpe.

Advance sections will benefit from this quality enhancement. The new facility can produce structural sections to the most demanding specifications, well inside the minimum requirements set by national and international standards for dimensional tolerance and material performance. Corus' tight manufacturing controls also enable production of bespoke sections where depth and flange/web thickness of a section can be tailored to the particular needs of a project.

The investments include the construction of a new world class Automated Distribution Centre at Scunthorpe, which will receive Advance sections from the adjacent mill and store and retrieve them as required while sheltered from the elements. This facility will improve customer service by ensuring that all products are despatched on time and in the best possible condition.

Other aspects of Corus' service leadership, such as a full technical advisory service to assist with all aspects of using Corus products, will continue to be provided. The company's commitment to technical development, to improving the effective application of steel in construction, will be underpinned by these new investments.

Mr Todd said: 'Corus is the best-positioned steel manufacturer to serve the UK construction market and these investments underpin that assurance. We have a comprehensive rolling programme and the highest level of technical support at both the product and the application level. For example, the industry will naturally turn to us for guidance during the transition to the steel elements of the new Eurocodes for design.'

Proving steel's sustainability credentials will be easy for specifiers of Advance sections. 'About 94% of steel sections were already recycled in the days before sustainability became such a key business driver, and that figure will rise and rise!' said Corus Construction and Industrial Marketing and Product Development Manager Roger Steeper. 'Significant work is underway on steel's contribution to sustainable development. Advance Sections have many of the qualities that help to achieve the balance between the environmental, economic and social performance that is so important to sustainable development. Corus takes its responsibilities towards the environment and the communities we work in very seriously, and designers can be assured that by specifying Advance Sections they are also making a contribution to the sustainability of their own projects.'

Corus has produced a brochure with a CD detailing the blue book properties of the Advance range. To request a copy please visit www.advancesections.com

Steel addition for listed buildings

Two Grade II listed buildings are being restored, with a new steel-framed structure inside to provide a new stylish office block for central London. Martin Cooper reports.

Marrying new steel to old steel was considered as the best option.

FACT FILE
16-18 Finsbury Circus & 18-31 Eldon Street, London
Main client: *Prudential Assurance*
Architect: *John Robertson Architects*
Structural engineer: *Waterman Structures*
Main contractor: *Bovis Lend Lease*
Steelwork contractor: *Bourne Steel*
Project value: *£50M*
Steel tonnage: *1,500t*

The retention of London's historical architecture is today paramount in developers plans for new buildings. Where once old buildings may have succumbed to the demolition contractor's wrecking ball, many older buildings now have preservation orders and refurbishment is the order of the day.

Nowhere is this more evident than in the City of London where new office space is at a premium and a number of recent developments have seen listed facades retained with a new - and sometimes higher - structure erected behind.

John Robertson Architects states that the redevelopment of 16-18 Finsbury Circus and the adjacent 18-31 Eldon Street is however much more than a facade retention job. The design strategy is essentially the amalgamation of what were three disparate buildings into one unified 'ring of development' potentially creating one corporate headquarters building.

This project involves the redevelopment and restoration of two Grade II listed buildings in London's Finsbury Circus Conservation Area. The client, Prudential Assurance, was granted planning permission by the Corporation of London in February 2004 and was strongly supported by English Heritage and City Heritage.

The Finsbury Circus structure is a grand Edwardian crescent terrace and was originally designed by Gordon & Gunton Architects in 1915 and completed in 1926. The building's Portland Stone facade and its main staircase are key features of particular architectural and historic interest within the Grade II listed building, and the main challenge is to knit new elements of the building into the retained existing structure.

The main challenge is to knit new elements of the building into the retained existing structure

Overall the site originally contained three interconnected buildings: the listed seven-storey buildings on Finsbury Circus; 18-25 Eldon Street which was a Victorian building and has been completely demolished, and 26-31 Eldon Street, a Portland stone faced Grade II listed building which is being retained.

The £50M scheme comprises 17,500m^2 of offices around a central atrium and 900m^2 of retail space fronting Eldon Street. This will create a new nine-storey office block with basement covering the entire site.

John Fuller, Project Manager for Bovis Lend Lease says a steel frame for the new build section was initially looked at during the conceptual stage. "Overall using steel was considered as the best option," he says. "Especially as the existing structure is steel framed, so steel to steel connections is a more practical solution. The choice of steel assisted a quicker construction process."

The Finsbury Circus Facade is being retained.

The three separate buildings will be combined into one.

"As well as knitting together old and new, steel has also allowed the floor build to be more compact with all services accommodated between the beams."

Bourne's contract involved building a novel arrangement to allow cherry pickers to stand on the decking without causing any damage.

However, marrying a new frame to an old steel framed structure is the most challenging aspect of the structural works on the project, Mr Fuller says.

The first major part of the work was to provide temporary support for the existing Finsbury Circus and Eldon Street facades and retained listed structure behind. The retained structure was braced with steelwork to ensure stability was maintained during demolition.

Steelwork contractor Bourne Steel commenced steel erection in June 2006. Overall Bourne will erect 1,500t of structural steel in approximately 3,700 individual pieces, with 100t used on the Finsbury Circus segment.

Rod Potts, Bourne Steel's Divisional Manager comments: "Although the Finsbury Circus frontage is being retained, some major works have been undertaken to raise the existing floor height."

The idea is to have a regimented 3.43m floor height throughout the project to match the existing storey heights. To bring the retained Finsbury Circus building into line with the new structure the screed has been removed from the existing concrete floors to reduce their levels while a number of supporting beams has also been reduced.

In the centre of the retained structure there were a series of fireplaces and chimneys which began at basement level. These have been removed and their large supporting beams which measured 700mm deep have been replaced and reduced.

"Once the chimneys were removed it wasn't necessary to have such large supporting beams," Mr Potts explains. "The chimneys went back two bays and the first beam of two on each floor is being reduced to that the floor height is increased," he adds.

Because these beams are connected to the retained facade it was impossible to remove them so Bourne Steel is inserting channels either side of the beams and then cutting away approximately 300mm off the bottom flange. The second supporting beam on each floor is being replaced with a new slimmer beam measuring 280mm deep that is being raised up into the depth of the slab.

The other major element connected to this part of the project has seen the original floorplan demolished down to the sixth storey and a new seventh floor and roof added. This will then marry into the overall floorplan of the new building. The original roof of this building housed a small plant room, and this will be moved to a new section of the Eldon Street building.

Barry Dobbins, Regional Director of Waterman says this part of the project called for some lengthy surveying and analytical calculation of the structure to ensure the load capacity of the existing columns and floor plate would cope with an extra floor. He says strengthening was needed to the columns in the form of additional plates to supplement overloaded columns.

Mr Dobbins adds that using steel has brought more flexibility to the project. "As well as knitting together old and new, steel has also allowed the floor build to be more compact with all services accommodated between the beams."

Running parallel with the Finsbury Circus building, Eldon Street originally consisted of two separate buildings. The facade of the listed building at 26-31 Eldon Street is to be replicated on the adjoining new structure with a Portland stone facade to match the existing facade. A new central bay entrance hall will provide access from this side of the development.

The new build section along Eldon Street and abutting the Finsbury Circus structure is a traditional steel column and beam structure consisting of eight-storeys and a steel-framed roof which will be glass clad. Set around a trapezoidal 11m x 18m atrium the new structure has a predominant grid plan of 6m x 4m with 415mm deep fabricated beams with 250mm deep penetrations.

Mr Potts explains that Bourne's contract also includes erecting steel decking for the new build section, and building a novel arrangement to allow cherry pickers to stand on the decking without causing any damage.

"We've made five sets of supporting frames from 305UCs which constrain the wheels of the picker and prevent any damage to the decking," he says. "We only have three pickers but making five frames means we can always move a picker to a spare frame."

The cherry-pickers have initially erected steelwork up to the second storey by working at basement and ground level. As Mr Potts explains, the frames will be used on the second level to allow erection up to the fourth storey, with the process repeated on the fourth level and the sixth floor.

Importantly, Mr Dobbins adds the new structure, although basically a free-standing building, takes all of the lateral stability for the entire project. This called for some intricate foundation works as the new piles had to avoid existing pad foundations.

Two artesian wells were also discovered under the demolished section and these had to be capped with new piled foundations - mostly steel ground beams - built over them. Bourne erected raking columns around the perimeter of the site at lower basement level to avoid transfers which would have otherwise impacted on the below ground headroom.

The project is scheduled for completion by September 2007, when central London will acquire a modern office block built around and incorporating restored listed features.

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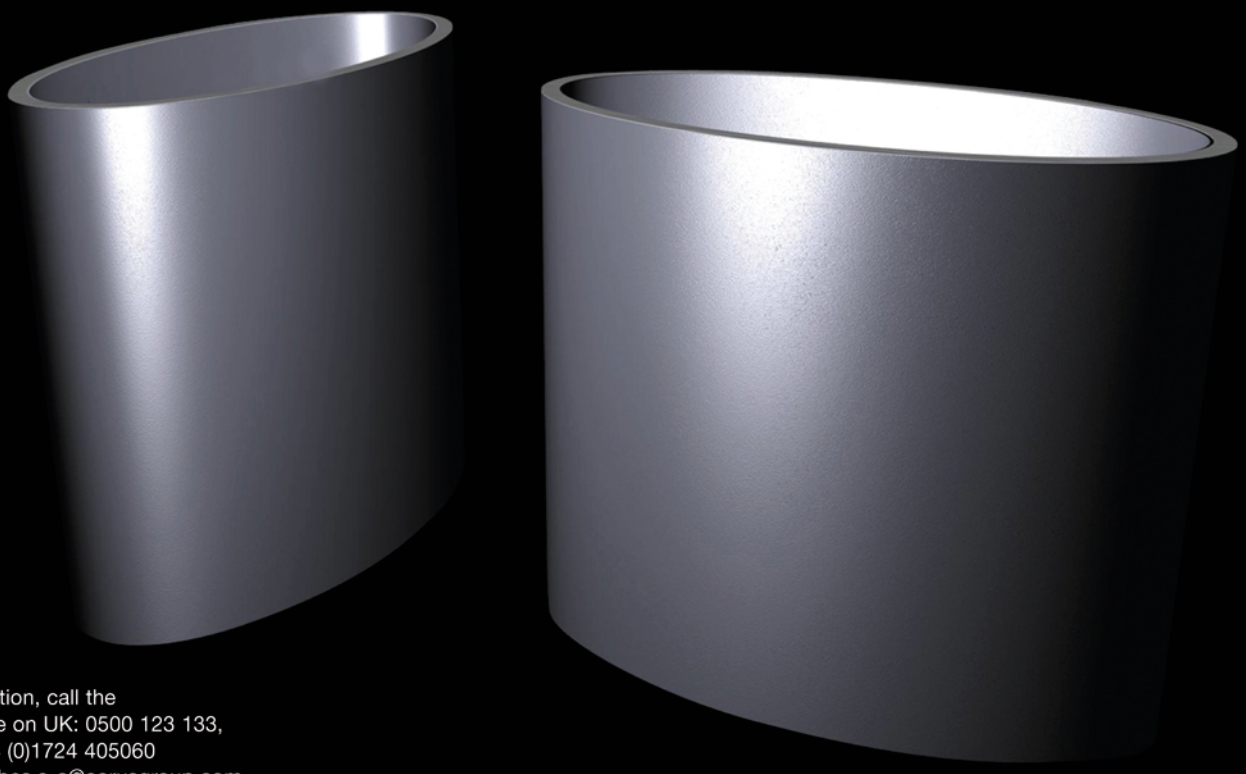

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A new ramp provides access to the rooftop parking

Steel puts the glitter in Golden Square

An innovative solution to extending a shopping centre in Warrington could be the model for similar city centre developments in the future, as Margo Cole reports

The growth in out of town retail parks has made life increasingly difficult for city centre shopping developments. Warrington is hoping to buck this trend with an ambitious plan to redevelop the town's 27-year old shopping centre and turn it into one of the country's top 40 shopping destinations.

Developer Lend Lease has taken on the existing Golden Square shopping centre and is investing £120M in refurbishing it and building an extension that will more than double its size. Big name retailers have signed up to the scheme, which is due for completion next Easter.

Lend Lease awarded the construction contract to Bovis, whose project manager Simon Pritchard says: "Our brief was to extend the existing shopping centre in a period of 107 weeks, but the big challenge is the phasing of the scheme. There are some key constraints, including relocating a live bus station, £4M of utility diversions and the need to maintain car parking to the existing shopping centre – which has remained open throughout the construction.

"The overall duration is sensible for a scheme of this nature if you can tackle it in one hit, but it's a real challenge if you've got the phasing issues that we have."

At the start of the project Bovis built a temporary bus station so that the existing facility – which sat on the site of the Golden Square extension – could be demolished to make way for the new buildings.

Bigger and better: the extension will be completed next year

Above and top right: The extended shopping centre will transform the centre of Warrington

The beam and slab solution gives a flat soffit to the car park levels.

Under a separate contract Kier then built a new bus station, which opened in August.

Getting transport to the shopping centre is really important to Lend Lease because, if the transport links are not good enough, or the parking inadequate, shoppers will simply go somewhere else. As a result, the completed scheme will incorporate 1,700 car parking spaces on four different levels: one in the basement beneath the shops, and three levels above the retail space.

This parking provision – particularly the upper levels – influenced the structural design of the extension, with the design team originally opting for a steel beam system that would have to be sourced from Finland, in combination with in situ concrete columns and precast concrete floor slabs. According to Simon Pritchard, this was highlighted as a key risk on the project if – as proved to be the case – the complexities of the phasing and site constraints meant that work would have to be re-sequenced. "The beams would have been fabricated in Helsinki, so it would have been very difficult to react to any issues we might have on site," he says.

The Golden Square extension consists of a new mall that wraps around the existing shopping centre

Instead, at the tender stage, Bovis and its structural steel partner William Hare offered an alternative, all-steel frame solution combined with precast concrete planks. "It isn't the same system, but it does satisfy the client's design intent, with a flat soffit throughout and long spans in the car parks," explains Pritchard. "That's a real win for the project and it's a unique solution."

The 34,000m^2 Golden Square extension consists of a new mall that wraps around the existing 29,000m^2 shopping centre, with retail space on one main level and a mezzanine above some of the shops. Above this are the three levels of parking.

Bovis and William Hare's solution, which is being used for the main retail floor and the upper levels of car parking, is to use a combination of pre-cast planks and asymmetric steel beams. An in-situ composite concrete topping provides horizontal stability.

"This solution gives us all the qualities of steel from a construction point of view," explains Pritchard. "The original design had concrete columns instead of steel columns so we would have had different elements that lend themselves to different contractors. Our solution ticks all the boxes from a design point of view, and we have made a solution that lends itself to a steelwork contractor. The precast planks have not been a problem for them.

The Bovis/William Hare solution also makes the foundation design more efficient than the original solution, because the steel columns are much lighter than concrete, so there is reduced loading on the piles.

Neat though the solution is, it still presents a technical challenge to William Hare. "The planks are 400mm deep and 15.6m long, so the logistics of putting them in and phasing the works so that they can sit in the bays was a real challenge," says Pritchard.

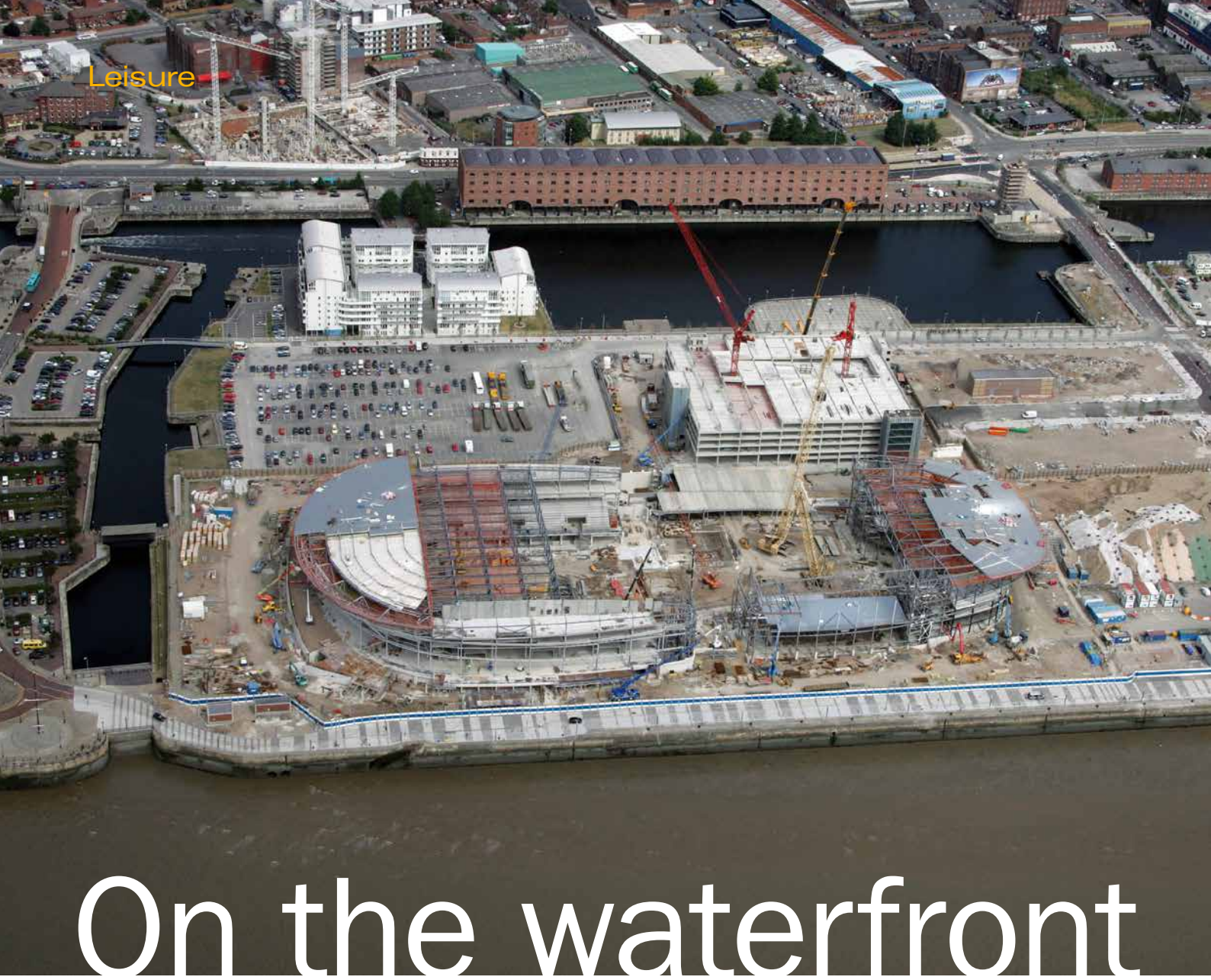
In all, William Hare's contract involves erecting 5,500t of structural steel and 68,000m^2 of the concrete planks. "The design interface between the steel frame solution and the 400mm concrete planks – which are over 15m long - was a challenge we overcame as a team," says a William Hare spokesman. "It has had to be designed and constructed in a very tight programme and within the constraints of the phasing."

As anticipated, the construction programme has had to be reprogrammed to accommodate problems with the utility diversions, which took longer than planned, and the relocation of an electrical substation, which stayed on site six months longer than expected. Bovis had split the extension building into different zones, and had to re-sequence the order in which the zones were built to take account of this.

Simon Pritchard says the all-steel frame solution was far more flexible when it came to responding to these changes than the original design would have been: "I do not believe we could have turned it around in the timescale required by the client after those utility delays. In situ concrete is very labour intensive, and mixing precast, in situ and steelwork is quite inefficient."

William Hare and Bovis believe their solution could work on similar retail developments where space is tight, and intend offering it to other clients elsewhere in the UK.

FACT FILE
Redevelopment of Golden Square shopping centre, Warrington
Main client: *Lend Lease*
Main contractor: *Bovis Lend Lease*
Steelwork contractor: *William Hare*
Steelwork tonnage: *5,500t*
Project value: *£120M*



On the waterfront

Liverpool is gearing up to become European City of Culture 2008 with the construction of an impressive new arena and convention centre. Martin Cooper reports.

FACT FILE
Liverpool Arena and Convention Centre
Main client: *Liverpool Vision*
Architect: *Wilkinson Eyre*
Structural engineer: *Buro Happold*
Main contractor: *Bovis Lend Lease*
Steelwork contractor: *Watson Steel Structures*
Project value: *£140M*
Steel tonnage: *6,000t*

Liverpool's city centre is currently a hive of construction activity. A major redevelopment and new build project, known as the Paradise Street scheme, is set to transform much of Liverpool's rundown centre, while a stone's throw away along the banks of the Mersey the impressive Kings Waterfront project is now beginning to take shape.

Located on the site of the former Kings Dock, Kings Waterfront is the single largest development in Liverpool and is being jointly promoted by a partnership of Liverpool Vision, English Partnerships, Northwest Regional Development Agency and Liverpool City Council.

Their aim is to create a visitor destination of international quality combining arena, conference and exhibition facilities - a centrepiece for Capital of Culture celebrations in 2008 - with a development of residential, hotel, office, retail, leisure, community and public open spaces.

The initial part of this huge project is the construction of the Liverpool Arena and Convention Centre which comprises a 9,500 capacity arena; an auditorium seating 1,350; a multi-purpose hall and 18 meeting rooms.

Built on the banks of the Mersey, the project involved some extensive groundworks before steelwork erection could begin. As Buro Happold's Project Principle Angus Palmer explains, the site was formerly occupied by dockside warehouses and wouldn't have been able to sustain the new structures without new piles being driven in to the ground.

The project involved some extensive groundworks before steelwork erection could begin

The Arena and Convention Centre both sit on a 3m-high podium, and this also required some major earthworks to be carried out by the main contractor Bovis Lend Lease.

Essentially the Conference Centre is a completely steel-framed structure while the adjoining Arena is a steel framed building sitting atop a concrete bowl, which lies beneath the top level of the podium.

Once complete both the Arena and the Conference Centre will have the flexibility to cater for events of differing sizes. For this reason, the Arena's floor links directly via the Galleria - a steel-framed

Clockwise from top left: The project rises up on the former docks site; Top: Watson will complete steel erection this year; Above: Large trusses span the Arena's main area; Below left: The completed project.

13m-high structure that joins both structures - into the lower level of the Conference Centre. Combined, this amounts to 7,000m^2 of near column-free exhibition space. The lower level of the Conference Centre measures 80m x 50m and is one large open multi-purpose exhibition room. In order to create the necessary open plan exhibition area, steelwork contractor Watson Steel has installed three pairs of large perpendicular trusses.

Alex Harper, Watson's Project Manager says the trusses accounted for some of the heaviest lifts of the job and consisted of members measuring 50m-long x 4.5m deep. These were craned into position in pairs to give four 20m spans. The trusses also carry all necessary ductwork and a maintenance walkway within their depth. On top of the trusses there is a double layer composite concrete slab which was installed to insulate the different levels from noise.

Meanwhile, on the Conference Centre's second level there is the auditorium, which covers just over half of the floorspace, 18 meeting rooms - with the largest holding 500 people - as well as kitchens and all other back-of-stage amenities.

Damian Rogan, Buro Happold's Senior Engineer on the project says in effect the Conference Centre is all column free. "As the lower level doesn't have columns it wouldn't have made sense to start on the second floor, and anyway the auditorium also needed an open plan design," he explains.

In effect the Conference Centre is all column free

"This level of the building was probably the most challenging aspect of the project," Mr Rogan says. "Getting the auditorium and meeting rooms to actually fit into the available space was difficult."

The 1,350-seat auditorium is constructed with a number of raking beams to create a dish-shaped arena, with pre-cast concrete slabs for the seating steps. The auditorium has a 15m deep stage at one end and facing this are two revolving seating areas known as 'drums'. Each holding 300 seats, these 'drums' can rotate 180-degrees and form two separate auditoriums, with their own stages, within the main arena. The 'drums' sit on a steel turntable which has radiating spokes which support a lightweight steel frame for the movable seating area.

The turntable, in turn, is supported by the large trusses below.

Steelwork has been used throughout the Conference Centre and the supporting superstructure of the building consists of 20m-long CHS 400mm-diameter columns supporting an array of steel beam work.

The adjoining Arena is also a steel-framed structure from podium level up and is constructed with predominantly 406 CHS columns. The Arena has two-tiers of seating formed by 300mm wide x 1m deep rakers at 10m centres, and these support pre-cast concrete slabs for the terracing. Above this there are VIP boxes with a wrap around balcony.

Mr Harper says the arena is being constructed with steel columns and beams supporting rakers and a truss roof. "A typical football stadium design, except for the roof," he says.

At the arena's southern elevation - facing the Galleria and conference centre - there is an acoustic wall, while the rest of the arena is bowl shaped and features terracing. At the outside of the curved northern elevation there is a large cantilever which is supported by 12 tapered Y-shaped columns.

Not only do these 400mm x 300mm RHS Y-columns support the curved end of the arena but they also support extended rakers which form the structure's entrance. Being supported by these same columns is the arena's three layers of cladding, which consists of traditional glazing, a green translucent covering and a metal rain screen.

Spanning both the Arena and Conference Centre are two curved cantilevered steel-framed roofs. "Steel was utilised to create the seamless architectural curves," Mr Rogan says. "There is some complicated geometry involved and only steel would have worked."

The Conference Centre roof is made up of 6m deep primary trusses sitting at 10m centres supporting 406 UB connecting beams with 6m spans. There are also secondary trusses which are 3m deep at 6m centres. All of this steelwork was needed to create the large spans over the auditorium and meeting rooms.

"There is some complicated geometry involved and only steel would have worked"

Both the Conference Centre and Arena roofs are made of two layers, with the lower section forming an acoustic barrier while the upper section will provide protection from the elements, as well as some additional acoustic properties. Between the two layers a 900mm void will consist of an insulation layer and an air gap.

The Arena roof steelwork consists of some very long trusses, the longest of which are 80m-long and weighing close to 100t. These members were lifted into position in two separate 40m lengths. To give the Arena roof its curved effect the trusses vary in length and depth, from 6.5m to a minimum depth of 4m.

Each of the two curved roofs have deep grooves, or slots, running along their length, and these areas contain plant rooms. The roof structures are also clad with bespoke sound proofing panels.

Watson Steel estimates it will complete its steel erection by the end of the year and full and final fit-out of the buildings is due to finish sometime during the Summer of 2007.

Before the Arena and Conference Centre are complete the next stage of the Kings Waterfront scheme is due to begin. An adjoining multi-storey car park is already nearing completion, but a hotel and residential buildings will start soon. The banks of the Mersey will never be the same again.

Above: The Conference Centre will have a service entrance at the southern elevation

Below: The new development will be a prominent riverside addition for Liverpool

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Sustainability matters

A new distribution warehouse near Heathrow Airport has fully demonstrated the sustainability of steel.

FACT FILE
ProLogis Park, Heathrow
Main client: *ProLogis Developments*
Architect: *Michael Sparks Associates*
Structural engineer: *Terry Collier Associates*
Main contractor: *Norwest Holst Construction*
Steelwork contractor: *Barrett Steel Buildings*
Steel tonnage: *230t*

Sustainability is increasingly important in all aspects of construction, and using steel is seen as the most advantageous option because it is a recyclable material.

More often these days, gaining planning permission for a new development can actually hinge on the ability of the construction team to demonstrate a structure's sustainable credentials.

Bearing in this mind, a new 55,000ft² warehouse was recently completed at ProLogis Park, Heathrow which boasts a structural steel frame which is 80% reusable when the building is de-commissioned.

Steelwork contractor Barrett Steel Buildings says it has followed a philosophy of the three R's - reduce, recycle and reuse - for some time, and this helped it deliver the sustainable warehouse.

Tony Walker, Barrett's Design Director says with these points in mind, the task was, with its client ProLogis, to design a building which could easily be disassembled and consequently maximise potential steel reuse, at no extra cost.

The philosophy of the three R's: reduce, recycle and reuse

The building in question comprises 50,000 ft² of warehouse space, with a 5,000 ft² integrated office, as well as goods and entrance canopies. The structure has twin 23.6m spans, is 10m to underside of haunch, 99m long and includes predominantly 8m-wide bays.

All steel members were hard stamped with the section size and grade to allow identification when the building is deconstructed at the end off its useful life.

"At the design stage every member was value engineered to maximise potential reuse," Mr Walker

says. “In practice this means minimising welding and notching and maximising bolting, so that fittings can easily be removed,” he adds.

In total, Barrett says all the steelwork is ultimately reusable or recyclable, but for ease of operation 80% of the frame is easily reusable, and this breaks down to: 61% of the rafters being reusable; 79% of the portal columns; 95% of the floor beams; 87% of the valley columns; 83% of the gable posts; 95% of the bracings and 100% of the galvanised ground beams.

To endorse its sustainability credentials even further, Barretts has recently become one of the first companies to achieve accreditation to the BCSA Sustainability Charter and has achieved Gold Standard, which is the highest level.

Mr Walker says the majority of the steel erection was fairly straightforward except for the office block. “This two-storey structure is inside of the warehouse and features some tapered feature columns and also has a sunscreen mesh canopy which required some intricate connections for the supporting steelwork,” he adds.

Ken Hall, Senior Vice President, European Management Board for ProLogis Developments says sustainability doesn’t end at producing environmentally friendly buildings, it runs much deeper than that. “ProLogis encourages its suppliers to embrace the whole sustainability process,” he says.

“Sustainability matters to us, and having key suppliers such as Barretts to help us innovate is an important part of the process,” Mr Hall says.

“A sustainable business brings clear advantages both now and in the future of the business, the environment and for the wider community. Barrett is committed to leading the sustainability agenda in the steel construction sector,” sums up Barrett’s Managing Director Richard Barrett.

The structure has twin spans.

80% of the frame is reusable.

FACT FILE
Lee Valley Athletics Centre, Edmonton, London
Main client: *Lee Valley Regional Park Authority*
Architect: *David Morley Architects*
Structural engineer: *Buro Happold*
Main contractor: *Shepherd Construction*
Steelwork contractor: *SH Structures*
Project value: *£16M*
Steel tonnage: *700t*

Steel on track

The Lee Valley Athletics Centre is a state-of-the-art facility boasting both indoor and outdoor tracks. Martin Cooper reports on steel's integral role.

East London will see a number of sports facilities being constructed in the coming years as the countdown to the Olympic Games gathers pace. But in the meantime, just a few miles from the designated Olympic site, an impressive new sports centre boasting both indoor and outdoor athletics tracks is nearing completion.

Located in Edmonton, the 9,700m² Lee Valley Athletics Centre, while primarily for the training and development of elite athletes on UK Athletics' World Class Programme, will also be home to the renowned Enfield & Haringey Athletics Club and serve the regional and local communities.

Although the project was designed before London was awarded the 2012 Games, due to its proximity to the soon-to-be-built Olympic Village and Stadium, it is also envisaged that the Centre will be a key training facility and possibly an event venue for London games.

Main contractor for the project Shepherd Construction started work on site in June 2005 and initially had to demolish an existing leisure centre which included an indoor swimming pool and squash courts, and outdoor five-a-side football pitches and a golf driving range.

Preliminary works also included some extensive piling, with more than 1,000 piles being installed to support the Centre's concrete slab.

"We found 'Blue Billy', a toxic by-product of gas production, and this had to be removed."

As Paul Steele, Shepherd's Divisional Construction Manager explains, the area where the Centre sits was originally occupied by football pitches and a former gravel extraction pit, and consequently the ground wouldn't have supported the new structure.

However, prior to any piling work being carried out the ground had to be decontaminated. "We discovered the site had been a landfill about 40 years ago and after doing environmental testing we knew there was quite a lot of material that had to be removed," Mr Steele explains.

Shepherd wanted to keep most of the overburden on site and consequently the spoil which wasn't contaminated was simply built into bunded terrace areas which surround the outdoor track.

"The problem we encountered was that there was quite a bit of highly contaminated ground and we found 'Blue Billy' which is a toxic by-product of gas production," Mr Steele says. "And this had to moved off site."

Once the earthmoving and piling work had been completed the Centre's concrete slab was then cast in one continuous week-long pour.

Sitting on top of this concrete slab the steel-framed Centre is 135m long x 85m wide and was erected by steelwork contractor S.H Structures during an eight week programme.

The single storey Centre consists of a banked 200m eight-lane running track - which is sunk into the slab, netted areas for throwing events, areas for jumps and pole vaulting and a mezzanine level upon which is a 130m-long straight sprint track.

Andrew Best, Project Leader for Buro Happold says the design of the Centre had to allow for all of the above events to be held within the Centre and a simple box with a sweeping curve over the sports hall was the starting point.

"We started off with a simple design and worked from there," Mr Best says. "The requirements included a clear open span sports area with enough clearance and height for events such as the pole vault," he adds.

In order to achieve the best fit with the minimum envelope the design incorporated a raised sprint track sitting on a pre-cast concrete floor above the toilets, gym and changing room block. This sector is constructed with predominantly UC columns and beams, with floor beams typically 152mm x 152mm UC's and UB's of 533mm x 210mm x 122mm.

Meanwhile, columns are generally 203mm x 203mm x 60 UC's, while in the main hall the columns are mostly 323.9mm x 10 CHS members which support 14 trusses, which in turn support the roof. "By utilising raking columns they not only helped with the structure's stability but also meant the trusses only had to span 59.8m," Mr Best explains.

The long span curved tubular trusses vary in depth from 1m - at the east elevation - to 2.5m at the west elevation which is adjacent to the steel box structure containing the raised sprint track. Each truss is connected to the next truss via CHS top and bottom chords with CHS infills. This creates a 'saw tooth' or 'north light' effect along the roof, and each truss is hidden beneath glazing.

S.H Structures says the trusses were fabricated in three sections which were checked for fit during the assembly process at its works facility. The sections were detailed in lengths to allow normal transport by road, with the maximum sub-assembly length being the central section which was 21.6m long and weighed approximately 12t. The trusses were also detailed with a conventional bolted splice instead of a fully welded splice, which the company says produced a quicker, safer and cost effective erection procedure.

Tim Burton, S.H Structures' Sales and Marketing Manager adds the project was fully modelled and detailed using Tekla X-steel. "In addition to being used for the normal production of shop fabrication and assembly drawings the 3D model was also used on site by our site manager as a planning and scheduling aid."

"The site manager was able to communicate the details of the erection sequence to the site operatives using precise 3D representation of the complete structure," Mr Burton says. "This has proved to be a very successful addition to the normal method of communicating the requirements of the site method statement."

The glazed facade is built entirely with structural steelwork

Sustainability played an integral part in the design of the Centre and in order to minimise the use of electricity the peaks of the trusses have windows which open automatically to allow natural light and fresh air into the building.

In order to allow more daylight into the Centre the entire south facade is glazed to the underside of the truss. This glazed facade is built up entirely with structural steelwork and has additional 'brise soleil' solar shading panels over the top.

Taking the sustainability aspect even further, the flat roof over the raised sprint track has a gravel roof to accommodate a rare British bird. As Mr Steele explains there are only about 16 nesting pairs of Redstarts and quite a few of these are found in the Lee Valley region.

"They like to nest on gravel-like ground," Mr Steele says in explanation as to why this material was used. The flat roof extends the entire length of the structure on the west elevation to a depth of approximately 10m.

Meanwhile on the outside of the Centre, Shepherd is currently putting the finishing touches to the outdoor athletics track. This area also required some extensive groundworks, but building an outdoor track on piled foundations was deemed far too expensive and so the area was dynamically compacted to the required flatness.

Whether the Centre ends up being used during the 2012 Olympics or not, without doubt North East London has acquired a new and first class Athletics Centre which is due to officially open in January 2007.

Above left: Outdoor and indoor athletics facilities will be available.

Above: The glazed facade will allow daylight into the centre.

Below left: A total of 14 trusses will support the roof.

Below: The centre will serve regional and local schools and clubs.

Lateral torsional buckling and slenderness

The expression for slenderness used in the lateral torsional buckling checks given in BSEN1993-1-1:2005 is different to that given in BS5950-1:2000. Mary Brettle, Senior Engineer at the Steel Construction Institute, examines lateral torsional buckling and shows how both slenderness expressions are based on the same elastic critical moment theory.

1. WHAT IS LATERAL TORSIONAL BUCKLING?

Lateral torsional buckling may occur in an unrestrained beam. A beam is considered to be unrestrained when its compression flange is free to displace laterally and rotate. When an applied load causes both lateral displacement and twisting of a member lateral torsional buckling has occurred. *Figure 1* shows the lateral displacement and twisting experienced by a beam when lateral torsional buckling occurs.

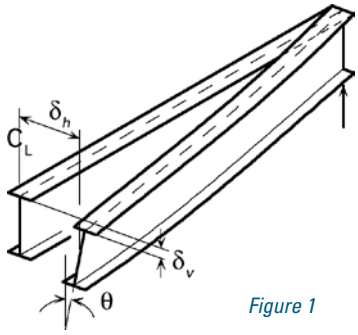


Figure 1

1.1 What causes the lateral deflection?

The applied vertical load results in compression and tension in the flanges of the section. The compression flange tries to deflect laterally away from its original position, whereas the tension flange tries to keep the member straight. The lateral movement of the flanges is shown in *Figure 2.*

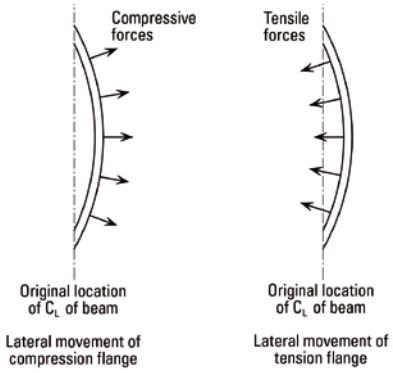


Figure 2

The lateral bending of the section creates restoring forces that oppose the movement because the section wants to remain straight. These restoring forces are not large enough to stop the section from deflecting laterally, but together with the lateral component of the tensile forces, they determine the buckling resistance of the beam.

1.2 Torsional effect

In addition to the lateral movement of the section the forces within the flanges cause the section to twist about its longitudinal axis as shown in Figure 3. The twisting is resisted by the torsional stiffness of the section. The torsional stiffness of a section is dominated by the flange thickness. That is why a section with thicker flanges has a larger bending strength (p_b) than the same depth of section with thinner flanges. This is why Table 20 of BS5950-1:2000 relates the value of pb to the ratio of depth / flange thickness (D/T) and Table 7 of BS449-2:1969 relates the value of elastic critical stress (C_s) to D/T.

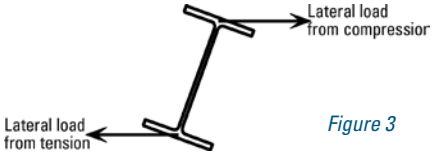


Figure 3

1.3 What affects lateral torsional buckling

Some factors that influence the lateral torsional buckling behaviour of beams are briefly discussed below:

Location of the applied load

The vertical distance between the load application point and the shear centre of the section affects the susceptibility of the section to the effects of lateral torsional buckling. If the load is applied at a location above the shear centre of a section it is more susceptible to lateral torsional buckling than if the load was applied through the shear centre. Applying the load at a location below the shear centre of a section reduces the susceptibility of the section to the effects of lateral torsional buckling. When the load is applied above the shear centre it is known as a destabilising load, with loads applied at or below the shear centre called non-destabilising loads. The effect of a destabilising load is considered by the use of effective lengths given in Table 13 of BS5950-1:2000, where the effective lengths are longer for destabilising loads compared to the non-destabilising loads.

The shape of the applied bending moment

The buckling resistance for a section subject to a uniform bending moment distribution along its length is less than the buckling resistance obtained for the same section subjected to a different bending moment distribution. Factors are included in design guidance to allow for the effect of different bending moment distributions. UK designers will be familiar with the use of the equivalent uniform moment factor (m_{LT}) in BS5950-1:2000.

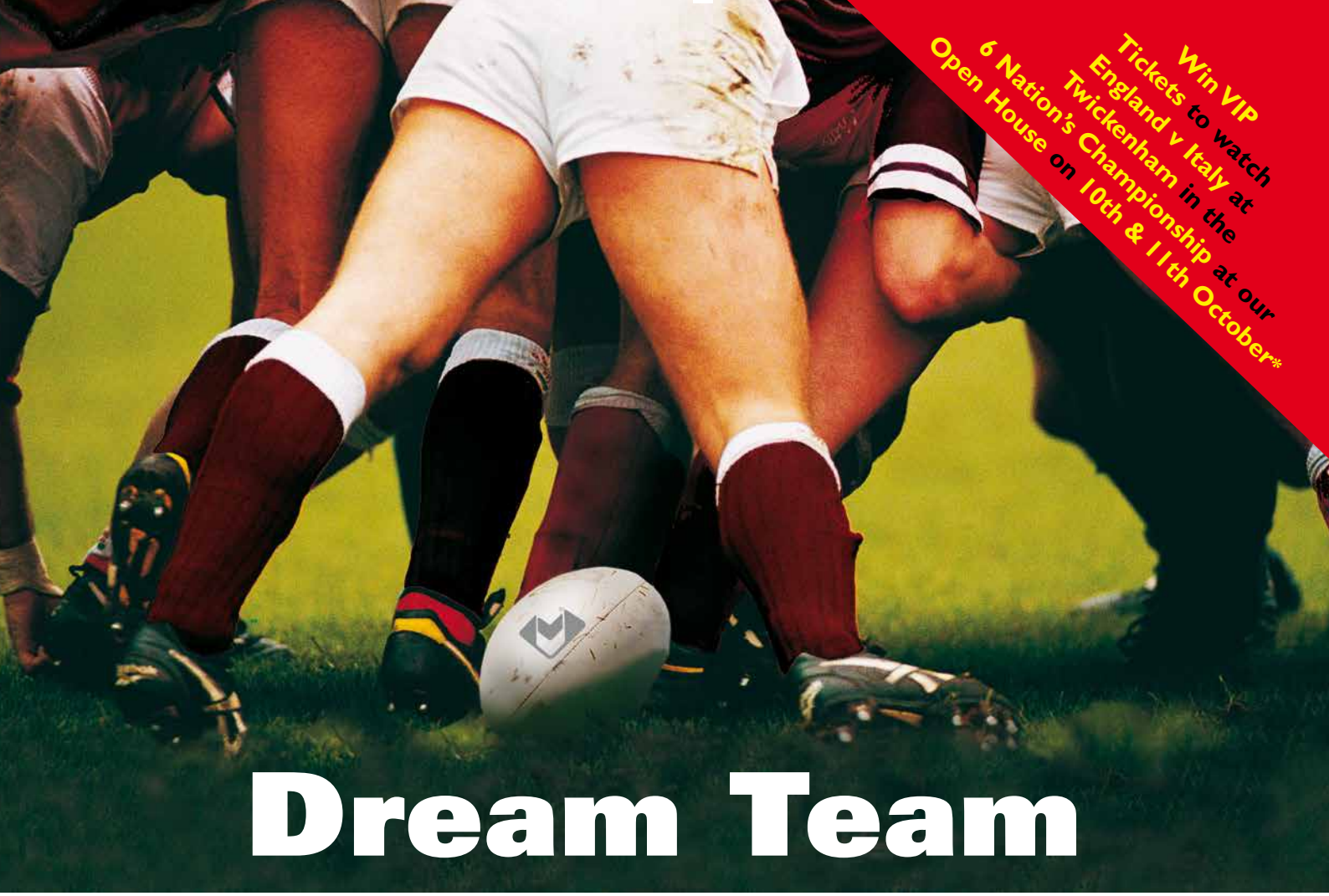
End support conditions

The end support conditions considered during the development of the basic theory for buckling moments are equivalent to web cleats that stop the web from deflecting laterally and twisting. For end conditions where more restraint is given to the section the buckling moment increases, with the buckling moment decreasing for end supports that offer less restraint to the section. BS5950-1:2000 considers effective lengths when determining the slenderness of a section to account for the effect of end restraint on lateral torsional buckling.

2. SECTION SLENDERNESS

The slenderness of a section is used in design checks for lateral torsional buckling. The following factors affect the slenderness of a section:

- Length of the beam
- Lateral bending stiffness of the flanges
- Torsional stiffness of the section



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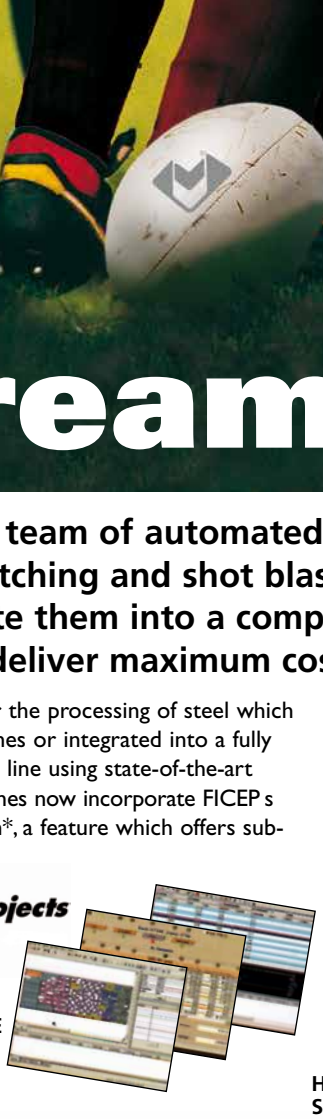

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Design codes need to account for the above factors in the guidance they give for determining the slenderness of a section.

The elastic critical moment (M_{cr}) is used as the basis for the methods given in design codes for determining the slenderness of a section. The elastic critical moment (M_{cr}) is similar to the Euler (flexural) buckling of a strut in that it defines a buckling load. Euler bucking defines the axial compression that will cause a strut to fail in elastic flexural buckling compared with the elastic critical moment that defines the moment that will result in failure due to elastic lateral torsional buckling of a beam. The Elastic critical buckling (M_{cr}) and Euler buckling (P_E) curves are shown in *Figure 4.*

The buckling moment of a section is affected by plasticity. Therefore the buckling moment resistance (M_b) cannot be greater than the plastic moment (M_{pl}) of the section. The buckling moment resistance curve shown in *Figure 4* shows that;

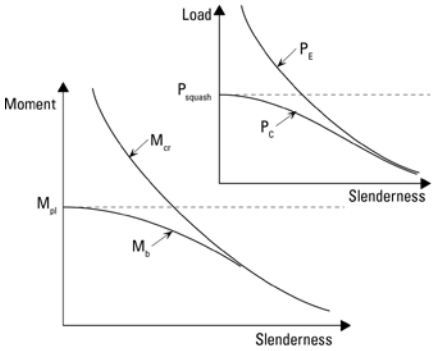

Figure 4

- very slender sections fail elastically by excessive lateral torsional buckling at an applied moment close to M_{cr},
- intermediate slender sections fail inelastically by excessive lateral torsional buckling at applied moments less than M_{cr},
- stocky sections will attain their full plastic moment (M_{pl}) with negligible lateral torsional buckling.

2.1 How British Standards use the elastic critical moment (M_{cr})

British Standard steel design codes all use M_{cr} as the basis for determining the slenderness of a section, but, the expressions used in the codes are not the same. Below the expressions given in some British Standards are considered.

BS5950-1:2000

The expression given for uniform I, H and channel sections with equal flanges is: $\lambda_{LT} = uv\lambda\sqrt{\beta_w}$

The above expression does not appear to consider M_{cr}. However, when the expressions given in Annex B of BS5950-1:2000 are considered it can be shown how the above expression is based on M_{cr}.

$$\lambda_{LT} = \sqrt{\frac{\pi^2 E}{p_E}}$$

Where:

$$p_E = \frac{M_{cr}}{S\beta_w}$$

β_w is defined in 4.3.6.9 as $\beta_w = \dfrac{\text{Design Modulus}}{S_x}$ where the design modulus depends on the classification of the cross section. Therefore, the expression for λ_{LT} can be rearranged to give:

$$\lambda_{LT} = \sqrt{\frac{\pi^2 E}{p_E}}\sqrt{\frac{M_c}{M_{cr}}}$$

BS449-2:1969

The guidance given for bending stresses in plate girders uses the elastic critical stress (C_s) to determine the permissible bending stress (p_{bc}). The elastic critical stress (C_s) can be expressed as:

$$C_s = \frac{M_{cr}}{Z}$$

BS5400-3:2000

The guidance given in this British Standard for overall lateral buckling given in clause 9.7.5 explicitly uses M_{cr} as follows:

$$\lambda_{LT} = \sqrt{\frac{\pi^2 E Z_{pe}}{M_{cr}}}$$

Where:

Z_{pe} is defined in 9.7.1 as $Z_{pe} = \dfrac{M_{pe}}{\sigma_{yc}}$

3. EUROCODE 3 DESIGN

The lateral torsional buckling design guidance given in BSEN1993-1-1:2005 requires a reduction factor (χ_{LT}) to be applied to the moment resistance of the cross section to give the lateral torsional buckling moment resistance ($M_{b,Rd}$). χ_{LT} is determined from a factor (Φ_{LT}) and the non-dimensional slenderness factor (λ_{LT}). The expression given for λ_{LT} is:

$$\overline{\lambda}_{LT} = \sqrt{\frac{W_y f_y}{M_{cr}}}$$

Where:

$W_y f_y$ is the moment resistance for the section ($M_{b,Rd}$), which is equivalent to M_c in BS5950-1:2000.

3.1 Calculating M_{cr}

For doubly symmetric sections the expression for M_{cr} is:

$$M_{cr} = C_1 \frac{\pi^2 E I_z}{(kL)^2}\left\{\sqrt{\left(\frac{k}{k_w}\right)^2 \frac{I_w}{I_z} + \frac{(kL)^2 G I_t}{\pi^2 E I_z} + (C_2 z_g)^2} - C_2 z_g\right\}$$

Where

E is the Youngs modulus
G is the shear modulus
I_z is the second moment of area about the minor axis
I_t is the torsion constant
I_w is the warping constant
L is the beam length between points which have lateral restraint
k and k_w are effective length factors
z_g is the distance between the point of load application and the shear centre (see *Figure 5*)
C_1 and C_2 are coefficients depending on the loading and end restraint conditions.

Further details on the above calculation of M_{cr} can be found in the access Steel document SN003a, which is given on the website: www.accesssteel.com.

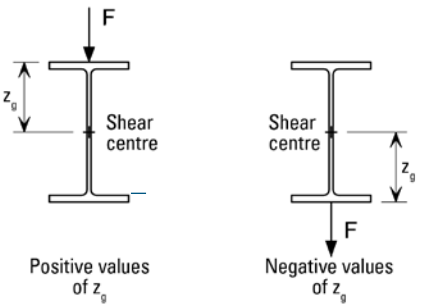

Figure 5

3.2 Don't panic, you can determine λ_{LT} without M_{cr}

After seeing the above expression for M_{cr} for doubly symmetric sections designers will be pleased to learn that λ_{LT} can be determined without having to calculate M_{cr}. From the formula for M_{cr} the following expression for rolled I, H and channel sections with non-destabilising loads has been determined:

34

New and Revised Codes and Standards

(from BSI Updates July and August 2006)

BS EN PUBLICATIONS

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

BS EN ISO 9445:2006
Continuously cold-rolled stainless steel narrow strip, wide strip, plate/sheet and cut lengths. Tolerances on dimensions and form.
Supersedes BS EN 10258:1997 and BS EN 10259:1997

BS EN 10083:-
Steels for quenching and tempering
BS EN 10083-2:2006
Technical delivery conditions for non alloy steels
Supersedes BS EN 10083-2:1991
BS EN 10083-3:2006
Technical delivery conditions for alloy steels
Supersedes BS EN 10083-3:1996

BS EN 10131:2006
Cold rolled uncoated and zinc or zinc-nickel electrolytically coated low carbon and high yield strength steel flat products for cold forming. Tolerances on dimensions and shape
Supersedes BS EN 10131:1991

BS EN 10140:2006
Cold rolled narrow steel strip. Tolerances on dimensions and shape
Supersedes BS EN 10140:1997

AMENDMENTS TO BRITISH STANDARDS

BS EN 1993:-
Eurocode 3: Design of steel structures
BS EN 1993-1-2:2005
General rules. Structural fire design
AMD 16290 CORRIGENDUM 1
BS EN 1993-1-8:2005
Design of joints
AMD 16291 CORRIGENDUM 1
BS EN 1993-1-9:2005
Fatigue
AMD 16292 CORRIGENDUM 1
BS EN 1993-1-10:2005
Material toughness and through-thickness properties
AMD 16293 CORRIGENDUM 1

BS EN 14399:-
High-strength structural bolting assemblies for preloading
BS EN 14399-5:2005
Plain washers
AMD 16228 CORRIGENDUM 1
BS EN 14399-6:2005
Plain chamfered washers
AMD 16229 CORRIGENDUM 1

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT

06/19976125 DC
BS ISO 15653
Metallic materials. Method of test for the determination of fracture toughness of welds.

06/30128176 DC
NA to BS EN 1994-2
National Annex to Eurocode 4. Design of composite steel and concrete structures. Part 2. General rules and rules for buildings

CEN EUROPEAN STANDARDS

EN 1991:-
Eurocode 1: Actions on structures
EN 1991-1:-
General actions
EN 1991-1-7:2006
Accidental actions
EN 1991-3:2006
Actions induced by cranes and machinery

EN 10083:-
Steels for quenching and tempering
EN 10083-1:2006
General technical delivery conditions

EN 10268:2006
Cold rolled steel flat products with high yield strength for cold forming. Technical delivery conditions

Lateral torsional buckling and slenderness

Continued from page 32

$$\bar{\lambda}_{LT} = \frac{1}{\sqrt{C_1}} 0{,}9 \bar{\lambda}_z \sqrt{\beta_W}$$

$\frac{1}{\sqrt{C_1}}$ Where:
is a parameter dependant on the shape of the bending moment diagram, values can be obtained from access Steel document SN002a and the forthcoming SCI / Corus Concise Guide to Eurocode 3.

$$\bar{\lambda}_z = \frac{L}{i_z} \frac{1}{\lambda_1}$$

L is the distance between points of lateral restraint

i_z is the radius of gyration about the minor axis

$$\lambda_1 = 93.9 \sqrt{\frac{235}{f_y}}$$

f_y is the yield strength of the steel

W_y is the plastic, elastic or effective section modulus (depending on the section classification)
$W_{pl,y}$ is the plastic section modulus.

Steel Construction Books

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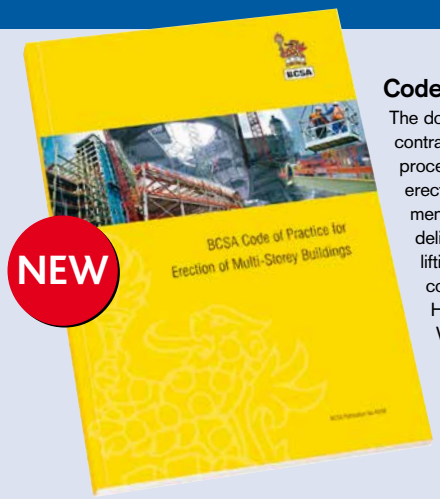


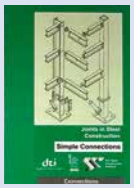
Code of Practice for Erection of Multi-Storey Buildings

The document provides guidance to clients, planning supervisors, principal contractors, designers and steelwork contractors on management procedures and methods, erection method statements, site preparation, delivery, storage, stability, lifting etc and aids compliance with the Health and Safety at Work Act

STEEL DETAILING - The Magenta Book*

Steel Details

This book provides practical advice on the issues that affect the efficient detailing of steelwork connections. The publication contains a rich array of details from actual structures and allows both engineers and architects to interrogate them.



CONNECTING - The Green Book*

Joints in Steel Construction: Simple Connections

Design guidance and worked examples based on BS 5950 - 1:2000 for connections in buildings designed as braced frames where connections carry mainly shear and axial loads only.

STEEL BUILDINGS - The Silver Book

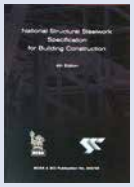
Steel Buildings

This book covers everything from steel design; section property tables; industrial and multi-storey buildings; cladding and decking; through to fire; transport and erection; software; contracts and case studies.

ASSESSING - The Brown Book

Historical Structural Steelwork Handbook

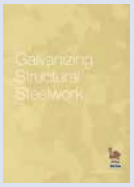
Developments from the mid-19th Century in iron and steel and the changes in design, loading and stresses; tables of section properties rolled since 1887; guidance on assessment of existing structures.



SPECIFYING - The Black Book

National Structural Steelwork Specification

Now in its 4th edition, the industry standard specification used in the majority of all forms of building steel framed construction; contains information on materials, welding, bolting, tolerances, etc.



GALVANIZING - The Beige Book

Galvanizing Structural Steelwork

An approach to the management of Liquid Metal Assisted Cracking. Practical guidance to clients, specifiers and engineers identifying circumstances where any increased risk of LMAC can be ameliorated.

DESIGNING - The Red Book

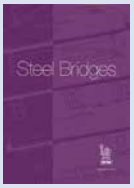
The Handbook of Structural Steelwork

This vital handbook gives practical design advice, worked examples, section properties and member capacities. This edition has been completely revised in accordance with BS 5950 - 1:2000.

SPECIFYING - The Grey Book

Commentary on the National Structural Steelwork Specification

This publication provides useful guidance to both specifiers and contractors and can be used as an informative reference.



BRIDGES - The Purple Book

Steel Bridges

A practical approach to the design of steel bridges for efficient fabrication and construction.

Code of Practice for Erection of Low Rise Buildings

Invaluable guidance on the safety aspects of: site management & preparation; delivery, stacking & storage of materials; structural stability; holding down & locating arrangements for columns; lifting & handling; interconnection of components.

Code of Practice for Metal Decking & Stud Welding

Clear, unambiguous and practical information for Clients, Planning Supervisors, Principal Contractors, Designers and Steelwork Contractors about the systems of work to be employed on site together with the required site safety attendances.

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Guide to Steel Erection in Windy Conditions

Covers issues as the maximum wind speed in which steelwork should safely be erected, the role of management and supervision in controlling work, comparative information concerning the use of weather forecasts in planning. Advice is also provided for designers concerning aspects raised by the effect of wind on steelwork during erection.

Health and Safety in the Office

The booklet covers all hazards found in offices and the precautions that must be taken to avoid injury and ill health. It provides basic Health & Safety information for employees.

Health and Safety in the Workshop – A Guide for Steelwork Contractors

It is intended that it should be given to each employee in the workshop, thereby assisting the company to discharge part of its legal responsibilities under Health & Safety Regulations.

Health and Safety On Site

The booklet covers a range of Health and Safety topics that site-based personnel need to understand in order to carry out work safely.

Health and Safety: a Pocket Guide for Managers and Supervisors

This booklet covers topics such as risk assessment, method statements, policies, setting up the workplace, inspections, training, statutory test etc and provides a useful, easy to understand, reference on Health & Safety Law.

For help and advice on steel construction and information about companies and suppliers visit www.SteelConstruction.org

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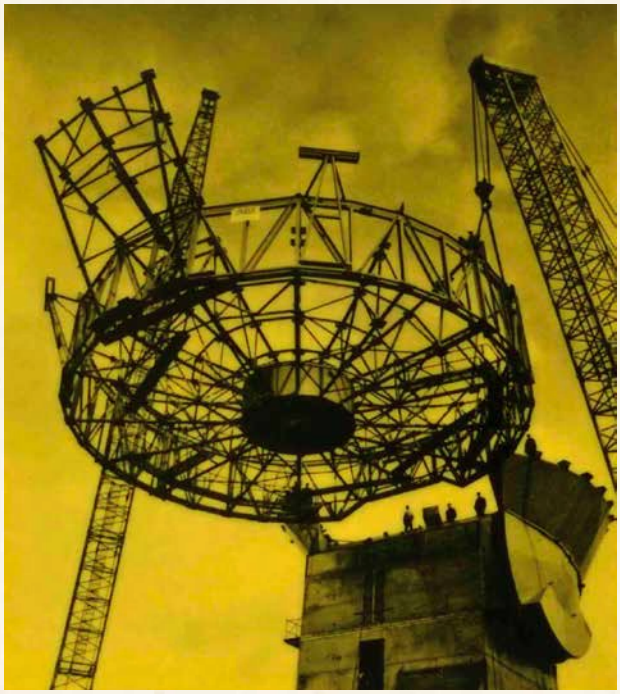
Building with Steel

Chilbolton radio-telescope aerial



Above: The radio telescope aerial virtually completed

Left: Hoisting the 37½ ton ring girder into position.

The 82ft diameter steerable aerial at Chilbolton, Hampshire, for the Radio Research Station of the Science Research Council has now reached the final stages of erection and commissioning. It is to be used for investigation into the propagation of radio waves, radiation from radio stars, for the tracking of artificial satellites and space probes, and will transmit and receive signals in the frequency range 100 to 10,000 M/cs. It incorporates the latest advance in constructional methods to obtain a stable parabolic surface accurate to within about 0.1in. A digital control computer will provide the tracking information for the electrical power servo-mechanisms controlling the azimuth and elevation motions of the aerial. This fully steerable aerial is the only large aerial in the United Kingdom specifically designed for satellite tracking apart from that at the GPO satellite communications terminal station at Goonhilly.

The complete aerial incorporates a steelwork structure weighing 52 tons and is designed to withstand winds of up to 100 mph and for a life of 20 years. It is supported on a 51ft high concrete tower with a 60ft diameter base.

The reflector surface comprises aluminium honeycomb sandwich 'petals' fitted to a steelwork support structure by expansion joints. This circular structure is an open framework constructed from all-welded sub-frames bolted and dowelled together on site. It is 82ft in diameter and 5ft deep at the centre and designed to follow the contour of the reflector and provide the surface with the required lateral and torsional stability.

The primary structural member is a ring girder measuring 56ft in diameter by 10ft deep, supported over two quarter arcs: for ease of transport and erection it was constructed and delivered to site in four all-welded quarter sections. Sixteen frame girders converge from the ring girder to a central hub, and radiate outwards to the periphery. A secondary 73ft diameter ring girder gives additional support to the outer radial frames and, in conjunction with the 16 intermediate outer radial rakers, provides adequate support for the outer area of the reflecting surface. The frames and rakers are braced together on the front and rear faces, the circumferential ties forming continuous hoops. The centre hub houses electronic equipment and is constructed of steel plate suitably gusseted.

A trial erection was followed by load testing of the structure to check the stiffness and natural frequency. Site erection of the 56ft ring girder unit was carried out at ground level and the sub-assembly then lifted to its final position, the structure at this stage weighing 37.5 tons.

All the civil, mechanical and electrical engineering work is being carried out under the cooperation of the Ministry of Public Buildings and Works. The main contractor was responsible for the design of the aerial.

AD 304
Columns in Braced Bays and Nominal Moments

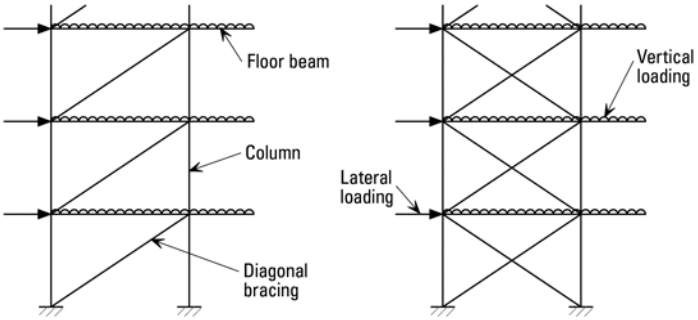


Figure 1 Typical Braced Bays in Simple Construction

Following the publication of AD 275 concerning columns in simple construction further questions have been asked about the design of columns in braced bays of simple structures and the use of nominal moments. This AD is written on the assumption that the centre lines of the members in the braced bays are coincident at each node and that the beam-column-bracing connection is designed and detailed so that the only nominal moments that arise are from the assumed eccentricity of the beam end reactions.

Unless some additional factors arise which makes the column a special case, see AD 275, columns in braced bays of simple structures should be designed in accordance with clause 4.7.7 of BS 5950-1: 2000 taking account of nominal moments.

Figure 1 shows typical braced bays which are usually analysed as pin-jointed frames with all the members at a node intersecting at a common point on their centre lines in order to determine the load effects in the members under vertical and lateral loading.

Assuming pinned joints in order to determine forces in members ignores the nominal moments described in clause 4.7.7 of BS 5950-1: 2000 which must be taken into account in the design of columns in simple structures. In most cases the value of the nominal moment is calculated from the assumed 100mm eccentricity of the beam end reaction from the face of the column and the net nominal moment at any level distributed as set out in clause 4.7.7.

Traditionally, when calculations were routinely performed by hand, the nominal moments for the columns were combined with the axial loads in the columns from the analysis of the pin-jointed frames. This should still be done even when the frame analysis is carried out using software. At least one commercially available software package combines the axial loads and nominal moments in the columns automatically. However, designers should be careful not to ignore the nominal moments in the design of the columns when analysing the pin-jointed frames for braced bays using general plane frame analysis packages.

Another AD will follow shortly which will describe the common cases where the settings out points of the diagonal bracing members in braced bays are displaced from the intersection of the centre lines of the beams and columns.

Contact: Thomas Cosgrove
Email: t.cosgrove@steel-sci.com
Tel: 01344 636555

OCTOBER

03: Disproportionate collapse and the revised building regulations
Introducing limit state design and explaining methods employed by BS5950-1:2000 for the design of members in bending, compression, tension and connections using worked examples.
location: Birmingham
cost: SCI Member £220 + VAT
Non Member £280 + VAT

04: Edge protection on steel frame structures seminar
www.easi-edge.co.uk
Offering advice to the industry on proprietary edge protection solutions including ground level assembly of edge protection; stair protection and void enclosure; loading bay enclosure; fall arrest for unloading of trailers; and free standing pedestrian and directional solutions. Examples will be given on safe installation procedures, reducing exposure to the hazards of installing and dismantling edge protection at height.
location: Tuxford
cost: free
contact: pbarnes@easi-edge.co.uk

04: Preparation for Eurocodes
Preparation for engineers in the use of Eurocode 3 covering the documentation needed for design, the design principles for steel and the major changes to present practice.
location: Croydon
cost: SCI Member £220 + VAT
Non Member £280 + VAT

04: Angle Ring & SCI design of curved steel seminar & factory tour
www.anglering.com
This popular design course run by the SCI contains worked examples from their publication P281 Design of Curved Steel (a copy of which is included in the course). A tour of Angle Ring's extensive steel bending facility is included, giving an insight into the methods used to shape and form steel sections, bar, tube and plate.
location: West Midlands
cost: £40.00 + VAT
contact: SCI

05: Hospitals seminar
Guidance on the design and construction of hospitals and healthcare buildings. The seminar is developed around real case examples and will introduce the latest methods of vibration design
location: London
cost: free

10: Multi-storey steel-framed structures
Showing designers how to deal with stability checks, robustness rules, and the SLS issues such as floor vibrations giving proper consideration of such things as service integration, fire resistance and construction practice.
location: Dublin
cost: SCI Member £220 + VAT (€360),
Non Member £280 + VAT (€400)

10/11: Ficep UK Ltd - Open House
www.ficep.co.uk
Ficep S.p.A is a manufacturer of machine tools for the steel industry. Ficep UK will be holding an annual open day where a number of materials and, for the first time, a number of agency products will be exhibited, with live demonstrations taking place throughout the day.
location: Leeds cost: free
contact: info@ficep.co.uk

17: Portal frame solutions
This course aims to provide in-depth coverage of the main issues surrounding the analysis, design and detailing of portal frames.
location: Leeds
cost: SCI Member £220 + VAT
Non Member £280 + VAT (€400)

17: Steel: The Show
This new series of seminars is being presented around the country at various locations. These morning seminars include discussions on vibration, Corefast, shallow floor construction, stadia, bearing piles, fire engineering and sustainability
location: Belfast
cost: free

18: Overview of new European standards for steel construction
www.steelconstruction.org
The aim of this seminar is to prepare engineers for the intriduction of the forthcoming European steel standards that will be introduced over the next few years. The seminar gives a general overview of the Eurocodes with more in-depth presentations of the loading (EN 1990 and EN 1991) and the steel design standard, Eurocode 3. The seminar also covers the new execution standard for steel structures; BS EN 1090-2, which will eventually replace BS 5950-2, and an overview of CE Marking and the harmonised standard for fabricated steelwork.
location: Huddersfield
cost: Member £60.00 + VAT, Non Member £280.00 + VAT
contact: gillian.mitchell@steelconstruction.org

04: Preparation for Eurocodes
For full details see 4 October
location: Birmingham
cost: SCI Member £220 + VAT
Non Member £280 + VAT

24/25: BS 5950-1:2000 – Understanding the essential principles
Introducing the concepts of limit state design before explaining in detail the methods employed by BS 5950-1:2000 for the design of members in bending, compression, tension and connections.
location: Dublin
cost: SCI Member £320 + VAT (€500),
Non Member £400 + VAT (€590)

NOVEMBER

01: Steel: The Show
For full details see October 17
location: London
cost: free

04: Preparation for Eurocodes
For full details see 4 October
location: Cambridge
cost: SCI Member £220 + VAT
Non Member £280 + VAT

10: SCI Annual Dinner
Guest speaker: Barry Cryer.
location: Landmark London, 222 Marylebone Road, London
cost: £150 + VAT.
contact: l.chamberlain@steel-sci.com

CONTACTS

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The British Constructional Steelwork Association Ltd

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

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

KEY

Categories

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

Quality Assurance Certification

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

Classification Contract Value

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

Notes

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

* For details of bridgework sub-categories contact Gillian Mitchell at the BCSA.

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The Steel Construction Institute develops and promotes the effective use of steel in construction. It is an independent, membership-based organisation. Membership is drawn from all sectors of the construction industry; this provides beneficial contacts both within the UK and internationally. Its corporate members enjoy access to unique expertise and free practical advice which contributes to their own efficiency and profitability. They also recieve an initial free copy of most SCI publications, and discounts on subsequent copies and on courses. Its multi-disciplinary staff of 45 skilled engineers and architects is available to provide technical advice to members on steel construction in the following areas:

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Details of SCI Membership and services are available from:
Pat Ripley, Membership Manager, The Steel Construction Institute, Silwood Park, Ascot, Berks.
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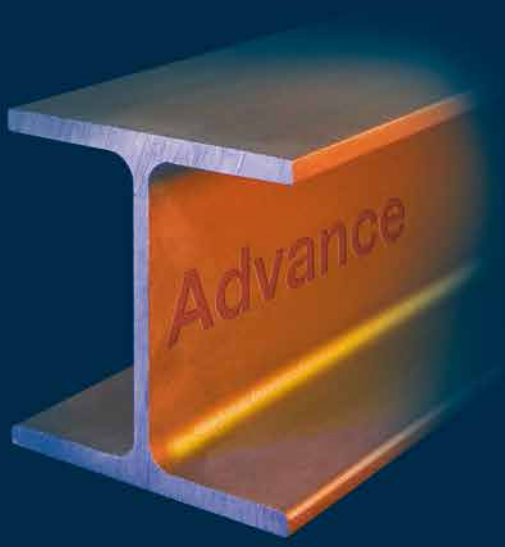

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