MAY 2007 VOL15 NO5

NSC

NEW STEEL CONSTRUCTION

www.new-steel-construction.com

Grandstand for Aintree
High-rise in Manchester
Steel speeds Glasgow hospital
Steel and sustainability

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steel projects

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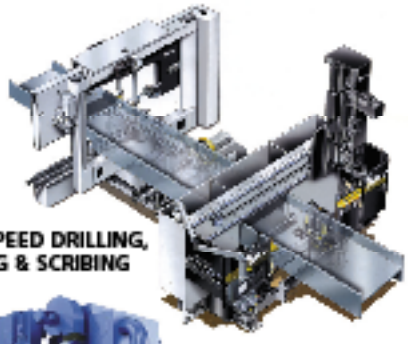

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Cover Image
AINTREE RACECOURSE, LIVERPOOL
Client: Jockey Club Racecourses
Architect & Structural Engineer: Building Design Partnership
Steelwork Contractor: Watson Steel
Photo: David Barbour/BDP

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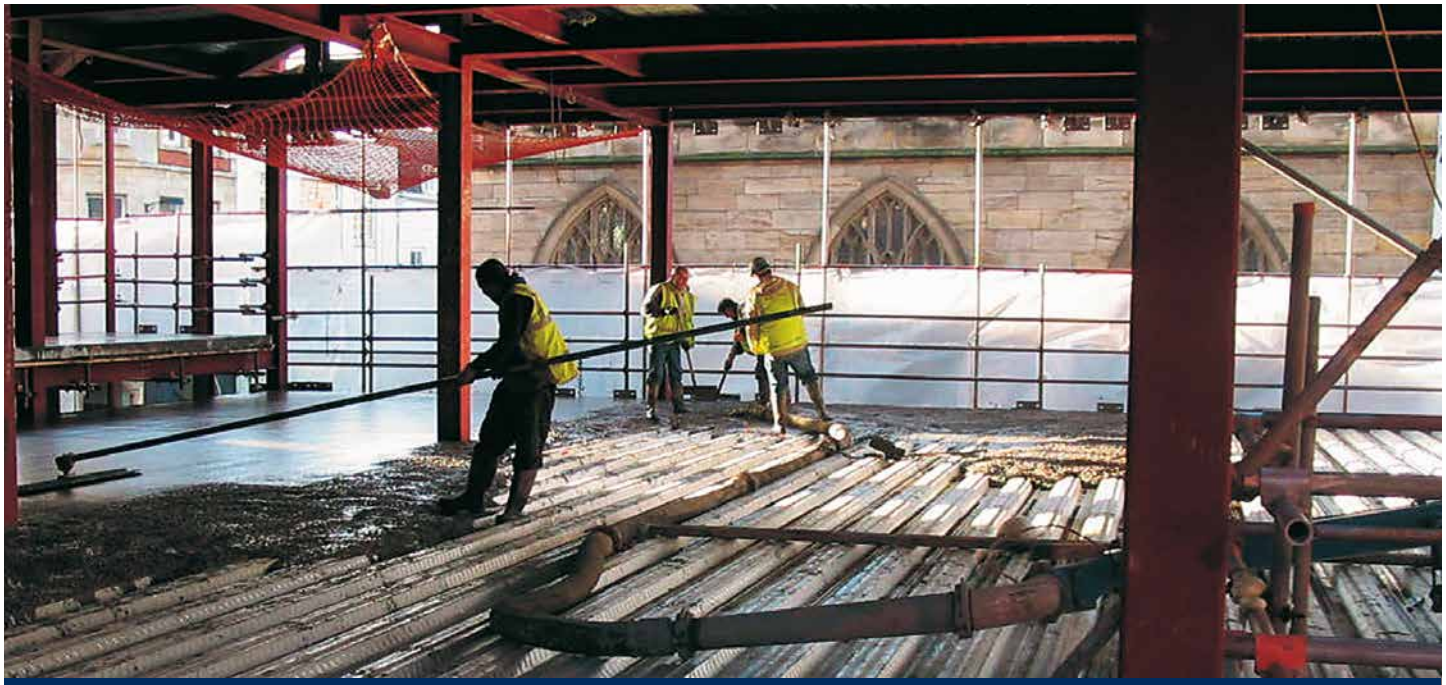

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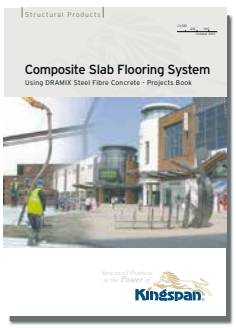

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Think sustainable – think steel

Nick Barrett - Editor

Sustainability has emerged as one of the main business decision making drivers across all industries in a remarkably short space of time. The pace of penetration of corporate thinking by sustainability is only going to get faster, partly thanks to several key pieces of legislation coming in over the next few years, including the UK's first ever Climate Change Bill which will aim at radical reductions in carbon dioxide emissions to be overseen by a Carbon Committee. It will affect all industries and all of us when we are at home.

Carbon committees can be expected to spring up in virtually all industries, and many companies, as we strive to meet the new targets to be set by the Bill. This will refocus attention on sustainability generally, and the constructional steelwork sector is already taking the steps necessary to thrive in the new carbon conscious world. Sustainability is of course about more than simply meeting targets for carbon emissions. To many it could not be more wide ranging, implying a new philosophy embracing how we are to interact with our planet.

Sustainability implies a balance between the social, economic and environmental factors involved in any calculation about the benefits and disbenefits of projects. With these factors in mind, in NSC this month we start a series of articles on sustainability and steel that will spell out the case for steel as a sustainable choice for constructional uses. There is a strong sustainability case for steel, most obviously its inherent reusability and recyclability. Some 99% of structural sections are already either reused or recycled, as are some 94% of all steel construction products.

What the series will do is reinforce the leading position that steel occupies during the coming debates on how to increase sustainability across all our industrial and domestic practices. The series will spell out the sustainability spin offs when choosing steel for benefits such as its structural efficiency, low waste, off site manufacture, flexibility, speed of construction, and just in time delivery.

The sustainability case for steel is strong when compared to competitive materials, and we have recently had independent verification of this in a straight comparison against a concrete framed alternative for a university building (NSC April).

Few choose anything other than steel on cost grounds and in future we can expect the same choices to be made when sustainability is the main driving force in decision making.

Competitive advantage maintained

On the subject of costs, the latest Cost Comparison Study update on commercial buildings has recently been completed and initial results confirm that structural steel frame solutions maintain their competitive advantage over concrete frames (details in next month's NSC). The cost of steel frames has risen over the six months to the end of 2006, by around 6%, but the price of concrete frames has been increasing fast. Rebar prices have gone up 16% in the same period and the price of concrete has been surging amid stories of 'cement famines' and raids by cartel busters across Europe. In situ concrete frames for some buildings have gone up by 15%.

The cost analysis partly explains the pleasing results of the Market Share Survey, which showed steel increasing its share in the key market sectors to record levels. The cost study proves that the competitive situation for steel remains virtually unchanged. With an economic case to match its sustainability virtues the outlook for steel in a sustainable world looks encouraging.

Industry comment urged on Eurocodes

The BCSA and SCI have both alerted the steel construction industry that draft National Annexes for Eurocode 3 have been published and are available for public comment.

SCI Deputy Director David Brown, said this is a vital period and an opportunity for the UK steel industry to influence its own future.

"Everyone involved in the steel sector should get hold of the documents and make their comments clear to British Standards," said Mr Brown.

BSI has issued three draft National Annexes: BS EN 1993-1-1 to Eurocode 3 Design of Steel Structures 1-1, General rules and rules for buildings; BS EN 1993-1-2 to Eurocode 3 Design of Steel Structures Part 1-2, General rules - Structural fire design; and BS EN 1993-1-1 to Eurocode 3 Design of Steel Structures Part 1.8, General rules - design of joints.

These National Annexes give the partial safety factors and other nationally determined parameters for use with parts of Eurocode 3 for the design of steel structures to be erected in the UK.

Comments on all three draft National Annexes must be sent to: Secretary, B/525/31 - Structural use of steel, BSI Head Office, 389 Chiswick High Road, London W4 4AL.

Comment period closes on 7 June 2007.

Major expansion for Caunton

Caunton Managing Director Simon Bingham (right) and Caunton Plant Manager Mark White in front of the new facility.

Caunton Engineering has invested £5M in a new manufacturing facility at its Moorgreen site in Nottinghamshire.

Called the Plane Building, the new building has a total floorspace of 3,442m^2 and includes both workshop and office space as well as a 25m-long loading dock.

Caunton Managing Director Simon Bingham, said: "The building offers us more space for manufacturing structural steelwork for the construction industry, and also allows us to adopt more sustainable methods."

The structure is 7.5m high and the roof has an uninterrupted span of 30m. The workshop is serviced by three electric overhead cranes.

A state-of-the-art surface water treatment system has been installed, along with energy saving features like solar thermal panels to heat water and roof lights to maximise natural daylight.

In addition to these sustainability innovations, Caunton has also made a planning application for installing a wind turbine at the new building, in line with government objectives to produce 10% of the UK's energy from renewable sources by 2010.

Slimdek changes offer safer installation

Recent side lap changes to the Corus Slimdek SD225 product mean it now offers contractors a safer installation procedure.

"With its new universal side lap, Slimdek can now be laid progressively away from the stack with the deckers primarily working on areas already decked," said Adrian Wallwork, Business Development - Structural for Corus Panels and Profiles.

"The old product could only be laid in one direction, but the changes mean the deckers can now work in the safest direction and avoid walking over areas not decked," added Peter Walker, BCSA Health & Safety Manager.

Another change to the product has seen the new Slimdek SD225's end bearing reduced to 50mm instead of the previous 75mm.

"This allows the product to be dropped directly into place and consequently an easier installation than was previously available," said Mr Wallwork.

Expert Eurocode website launched

The Institution of Civil Engineers (ICE) and the Institution of Structural Engineers (IStructE) have combined their expertise and launched a Eurocodes Expert website: *www.eurocodes.co.uk*

The site aims to be the authoritative source of information on structural Eurocodes and is supported by an extensive range of content partners including SCI.

The website uses a traffic light system to indicate the current UK status of each of the 58 Eurocode parts. The site also provides easy access to comprehensive support resources including publications, events and courses.

ICE Vice President Scott Steadman, said: "The new website, developed in close conjunction with key construction industry stakeholders, represents a major step forward in our continuing campaign to develop greater awareness and understanding of the Eurocodes."

The design and content of the website was overseen by a steering group drawn from the IStructE Standing Committee on the implementation of the Structural Eurocodes, chaired by Professor David Nethercot OBE and ICE's Eurocodes Expert Advisory Group, chaired by Professor Haig Gulvanessian CBE.

Shortlist announced for SSDA

The diversity of steel construction is demonstrated by the shortlist for the 2007 Structural Steel Design Awards, which was announced in April.

There are a total of 14 projects shortlisted which include bridges, transportation infrastructure, arts buildings, a museum and a roof structure. The winners will be announced at a presentation at Old Billingsgate in London on 19 June.

The full shortlist is:

The Alnwick Garden Pavilion and Visitor Centre, Northumberland
Royal Air Force Museum, Cosford
Transport Interchange, Finsbury Park, London
The Young Vic Theatre, London
Palestra, Blackfriars Road, London
10 Queen Street, London
Bishop's Bridge Road Bridge, London
Clyde Arc Bridge, Glasgow
Newport City Footbridge, South Wales
Pont King Morgan, Carmarthen
Chartist Bridge, Blackwood
Sheppey Crossing, Kent
St Pancras Station Extension, London
New Toll Canopy, Toll Plaza, Forth Road Bridge

Jumbo laser set for UK debut

Laser Tube Cutting, part of the Barrett Steel Group, will install the world's largest tube laser at its West Midlands facility in September.

The machine, known as the Jumbo and manufactured in Italy by BLM Adige, can process steel tubes up to 18m in length, 508mm in diameter and up to 16mm thickness.

David Cleaver, Laser Tube Cutting's Product Development Manager, said this is the only machine with this processing capability and size to be located in the UK.

"The Jumbo lives up to its name both in the size of the sections it can process to the shear scale of the machine," added Mr Cleaver.

Materials that can be processed include mild steel, stainless steel, aluminium and pre-galvanised steel.

"The Jumbo, unlike our other tube lasers, can also add weld preparations during the process which saves time," said Mr Cleaver. "But the biggest advantage is the fact that we'll be able to increase production to include a full range of sections."

The installation of the Jumbo machine is part of an on-going investment programme which Laser Tube Cutting said will enhance its position as the UK's leading tube and hollow section processor.

During April the company installed its fourth cutter, a combination flat bed/tube laser. This machine can produce up to 6m long finished pieces in tube, with up to 225mm diameter and square or rectangular hollow sections 160mm x 160mm to 200mm x 100mm.

CE Marking guidance

For most purchasers, the CE Marking of steel sections, bolts and welding consumables is relatively new and therefore many may not know what they should be looking for.

"Those ordering and checking goods must be able to identify a valid CE Mark and know what the certification should contain," said Dr David Moore, BCSA Director of Engineering.

All manufacturers of CE Marked products are now required to have a EC Certificate of Conformity. This should be signed by the notifying body and show the specific range of grades and products covered.

"It is not a blanket certificate for all products and the manufacturer should only be CE Marking those items listed on the certificate," said Dr Moore.

The EC Certificate of Conformity should include the following: name and address of notified body; name and address of the manufacturer or agent; description of the product; provisions to which the product conforms; particular conditions applicable to the use of the product; the certificate's number; conditions and period of validity, and name and position of the person empowered to sign the certificate.

The notified body must be approved by the EC and this can be checked by visiting website: *http://ec.europa.eu/enterprise/newapproach/nando/*

Meanwhile, manufacturers are also required to produce a Declaration of Conformity which should contain the name and address of the company, the description of the product along with information accompanying the CE Marking.

Global deal for nuts and bolts

Left to right: Tony Brown, Managing Director of Cooper & Turner; Murray Findlay, Managing Director of MBW; and Ian Wrightson, Partner at advising accountancy firm Mazars.

Leading industrial nuts and bolts manufacturer, Cooper & Turner, has merged with its largest customer, McLean Buchanan & Wilson (MBW), in a multi-million pound deal.

In a bid to break into new international markets, the merger will also provide Cooper & Turner with an enlarged sales network, while strengthening MBW's position in the Far East market.

The combined turnover of the two companies is expected to grow from £23M to £30M over the next two years following the deal.

Tony Brown, Managing Director of Cooper & Turner, said: "We've worked with MBW for over 25 years and during this time we've formed a very close relationship."

In addition to Wembley Stadium, other major construction projects that Cooper & Turner has supplied fasteners to include Hong Kong's Tsing Ma Bridge and the Channel Tunnel.

AROUND THE PRESS

Construction News
29 March 2007
Core blimey
Workers lower in a section of steel lift and stair core at an eight-storey office development in Liverpool. Billington Structures used the Bi-Steel Corefast system from Corus to erect the cores at the St Paul's square scheme, shaving 21 weeks from the build programme.

Construction News
5 April 2007
Galliford pumps life back into Bermondsey
The flexibility of the steel frame has allowed the designers to sneak in an extra storey. By welding an extra base plate on the bottom flange of the steel beams and locating the concrete floor within the web, the designers have saved space.

Construction News
12 April 2007
Concrete advertisement was misleading
The Advertising Standards Authority has criticised an advertisement implying the UK steel industry supports unsafe working practices.

Building
13 April 2007
You only live twice
The steel frame was the main package and its timely delivery was crucial to the project's success. *(Referring to Pinewood Studios.)*

Contract Journal
11 April 2007
The inside out theatre
The steel roof itself is made up of a number of 6m-deep trusses, which have spans varying from 25m to 30m. The roof is also functional, explains Woodhouse: "The plant room hangs from the bottom cord of the trusses and acts as ballast.

Contract Journal
18 April 2007
Broadgate's crowning glory
The tower structure itself is supported by six giant A-frames, which stabilise the tower up to level five. Above this, the structural steel is characterised by giant diagonal cross-braces, which will give the building a distinctive criss-cross facade when complete.

Updated Red and Blue handbooks

A new Red Book will be available this month (May) giving practical design advice, worked examples, section properties and member capacities all in accordance with recommendations given in BS 5950-1: 2000.

This latest addition will include the additional 21 new Corus Advance sections and the section property and member capacity tables have been dual titled to reflect the relationship between BS 4 sections and the Advance range of sections. The tables for hot formed tubes have also been dual titled.

In June a new Blue Book will also be published giving a comprehensive range of member property and capacity tables in accordance with BS 5950-1: 2000.

This handbook also includes the new Advance sections and all tables are dual titled. The tables for hot finished hollow sections have also been dual titled to show the relationship between BS EN 10210-2 sections and the Celsius range of sections.

The Red Book will be priced at £40 and the Blue Book £80. Contact the BCSA on 020 7839 8566 or SCI on 01344 636525 to place orders.

New distribution centre for Pineham

Working on behalf of main contractor Buckingham Group, Atlas Ward has started work on a new distribution centre in Pineham, near Northampton.

Atlas Ward is responsible for the design, fabrication and erection of all steelwork for the project.

The structure has an overall footprint in excess of 180,000m^2 and will require Atlas Ward to erect more than 2,100t of structural steelwork.

Developer ProLogis has already pre-let the distribution centre to one of the leading supermarket chains.

When completed the development will provide approximately 1,500 jobs.

Bigger premises for Cordell

The Cordell Group has completed the relocation of its entire structures operations from Teesside to a bigger facility in Sunderland.

All of the company's structural steelwork and plate fabrication, as well as large manufacturing work, will now take place within one 21,000m^2 facility.

Sunderland Workshop Manager Mel Davis, said: "By managing all structural work at a single facility we have improved flexibility and efficiency, which has increased our manufacturing capacity."

The facility in Sunderland has recently made a number of equipment purchases including the installation of a saw drill line.

"The new equipment will help us to become one of the leading structural contractors in the area," added Mr Davis.

Showcase steel event for London

Corus and the BCSA will host a Steel Day at Old Billingsgate in London on 19 June to showcase the positive aspects of the modern steel construction industry.

The event includes an exhibition, a programme of short seminars taking place throughout the afternoon, a photographic display of the 14 projects shortlisted for the 2007 Structural Steel Design Awards (SSDA) and an invitation only evening awards ceremony where this year's SSDA winners will be announced.

The exhibition will be open from 1.30pm and more than 40 exhibitors have reserved spaces including steelwork contractors, equipment manufacturers, computer software specialists and structural component producers.

The seminar programme will consist of: Innovations in steel construction; Fire engineering; Eurocodes; Steel bridges; Sustainability, and Economics of steel construction.

For more information and to register for the day event visit: *www.steelday07.com*

Allerton supplies support masts for Dublin Airport

Two steel suspension masts have been erected at Dublin Airport as part of the on-going £85M Pier D construction project.

Fabricated, shot-blasted, painted and supplied by Allerton Engineering, working on behalf of main steelwork contractor SIAC Butlers Steel, the two 26t masts are each 35m tall and support a new bridge connecting the terminal building with the new Pier D.

"The masts provide an integral structural element for the new bridge as the support cables will be fixed to them," said Trevor Salmon, Project Manager for Allerton Engineering.

Each mast will have an optical beacon at its tip as a warning to aircraft. "We supplied the masts with fixings for the beacons and cables already in place," said Mr Salmon.

Pier D is a new 15,000m^2 boarding gate facility which is due to open this Autumn. It will have 12 boarding gates serving 14 aircraft parking stands.

Steel tops the shopping list at two-storey B&Q

Barrett Steel Buildings has recently completed steelwork erection for a new two-storey B&Q superstore in Stevenage.

Main contractor Simons Construction awarded Barrett a design and build contract for all structural steelwork and associated sub-trades.

Jonathan Davis, Barrett's Associate Design Director, said the building is a beam and column structure on the lower level with a traditional portal frame above.

"We used universal sections on the ground level and erected a lightweight portal for the upper storey," said Mr Davis.

The two-storey superstore is 110m long, 65m wide and 17m high. The ground floor has a height of 8m and above this Barrett has installed 400mm thick pre-cast concrete planks.

B&Q stipulated a tight deflection criteria which meant the simulation of a ground floor finish in what is a suspended second level. "Ordinarily the deflection would be around 50mm, however B&Q's criteria restricted it to 10mm and our design had to be adapted accordingly," said Mr Davis.

The B&Q store is scheduled to open in early 2008.

NEWS IN BRIEF

The BCSA's '**Safety in Steel Construction**' (SiSC) can now offer health and safety site inspections and fire risk assessments. The services are available to non subscribers and travel costs will not be charged except when a location is outside of England and Wales or in excess of a 50 mile radius of Glasgow or Edinburgh. For further information contact Peter Walker at: *pete.walker@ steelconstruction.org*

FASET has published a best practice guide entitled 'The selection of access methods to install and dismantle **safety netting**.' Copies of the guide are available for free on the FASET website: *www.faset.org.uk*

A revised edition of the **Scottish Technical Handbooks** came into force on 1 May 2007. The handbooks provide guidance on achieving standards set in the Building (Scotland) Regulations 2004 and are available in two volumes, for domestic and non-domestic buildings. The handbooks are available from website: *www.sbsa.gov.uk*

BSI has issued the National Annex for **BS EN 1991-1-6: 2005** 'Actions on Structures - Part 1.6: General actions - Actions during execution' for public comment. Those wishing to comment must do so before 30 May 2007 and write to: Secretary, B/525/1 - Actions (loadings) and basis of design, BSI Head Office, 389 Chiswick High Road, London W4 4AL.

HSE reiterates crane safety check procedure

In response to a number of recent high profile tower crane accidents, the Health & Safety Executive (HSE) has restated that safety checks need to be carried out on cranes before they are used for the lifting of personnel.

As a result of the HSE's National Prohibition Notice, contractors have been required to check cranes on a regular basis for sometime.

"As the cranes often belong to others, the contractors don't always carry out their checks," said Peter Walker, BCSA Health & Safety Manager. "The HSE is just reminding them to do the checks, whether or not they own the equipment."

The British Standards' BS 7121-2 gives additional recommendations for cranes that are used for lifting personnel and suspended baskets.

"All cranes need to be thoroughly examined at least every six months or in accordance with a written scheme of thorough examination," said Mr Walker.

Contractors should take note of Annex E. This gives an example of a personnel carrier pre-use check form that should be used on a regular basis as established by a safety management system.

Mr Walker said some additional concerns have been identified that contractors need to address as part of their pre-use check.

"Check the six monthly inspection has taken place, confirm what repairs were identified and if they were carried out, and ensure the crane driver and all other personnel are sufficiently trained," added Mr Walker.

New Middlesbrough campus under way

Steelwork is under way for the new Middlesbrough College located at Middlehaven, the former dock area of the town.

The new educational facility will occupy a 31,000m² site and offer accommodation for 20,000 students.

When it opens in September 2008, the Middlehaven campus will replace the college's four existing sites around Middlesbrough.

Steelwork contractor Elland Steel is erecting approximately 1,000t of structural steel for the main one-storey college building.

The college is the first part of Tees Valley Regeneration's much larger project which will eventually transform the 250 acre site into a mixed use waterfront destination.

Diary

For all SCI courses, contact Sandi Gentle, email: education@steel-sci.com telephone: 01344 636500
For BCSA seminars contact Gillian Mitchell, email gillian.mitchell@steelconstruction.org telephone: 020 7839 8566
For all Corus events visit www.corusevents.com, email events@corusgroup.com telephone: 01724 405060

1 May 2007
Frame Stability
1 day seminar
Dublin

15 May 2007
Portal Frames
1 day seminar
Milton Keynes

17 May 2007
Curved Steel
1 day seminar
in association with Angle Ring
Tipton, Birmingham

22 May 2007
Floor Vibrations - update
1 day seminar
Birmingham

22 May 2007
One day seminar on 3D Modelling for the Steel Construction Industry.
Cost £80 + VAT
(£60 + VAT to BCSA members).
Cedar Court Hotel, Huddersfield

23 May 2007
New European standards for fabrication & erection of steel and alumunium structures
One day seminar with The Welding & Joining Society. £170 + VAT (£140 + VAT to BCSA members). National Motorcycle Museum, Birmingham

5 June 2007
Frame Stability
1 day seminar
Plymouth

6-7 June 2007
The design of steel bridges
Wrightington Hotel & Country Club, Wigan.
£215 inc VAT. www.corusevents.com, email events@corusgroup.com.
t 01724 405060

12 June 2007
National Structural Steelwork Specification
Half day seminar, Huddersfield.

12 June 2007
Portal Frames
1 day seminar
Dublin

19 June 2007
Floor Vibrations - update
1 day seminar
Manchester

19 June 2007
Steel Day
Exhibition and Seminar,
Old Billingsgate,
Lower Thames St, London
This free event includes an exhibition and a programme of short seminars taking place throughout the afternoon.
For more information and to register please visit *www.steelday07.com*

26 June 2007
Disproportionate collapse and the Building Regulations
1 day seminar
Plymouth

3 July 2007
Floor Vibrations - update
1 day seminar
Cardiff

Countdown to Eurocode Implementation

March 2007 | April 2007 | May 2007 | June 2007 | July 2007 | August 2007 | September 2007 | October 2007 | November 2007 | December 2007 | January 2008 | February 2008 | March 2008 | April 2008 | May 2008

Before you can design...

You need the Eurocodes for loading and for material resistance. Each part of every Eurocode has a National Annex, unique to the country where the structure is to be built, which you will also need.

Most Eurocode parts are published, but not all the National Annexes.

An important National Annex that has not yet been published is for EN 1991-1-4, which is the code for wind loading. No design in any material can properly start until this is published—it is expected later in 2007.

The National Annex for both the Steel and Composite Eurocodes are expected to be published by the end of 2007 so design will be possible from early 2008.

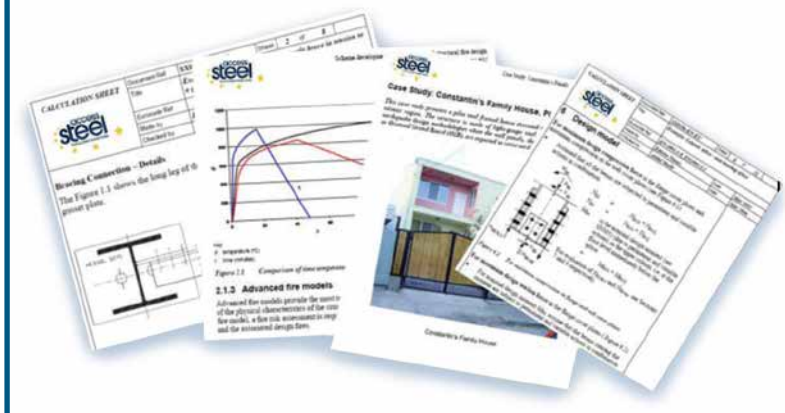
Don't be put off – Eurocode design can be simple. See the New Steel Construction article in Apr 2005 Vol 13 No 4 (visit *www.new-steel-construction.com* and search the archive).

Help for Steel Designers

There is a great deal of work underway to help designers use the Eurocodes for steel design. Software will be modified, and a range of guidance published. These Eurocode guides will be ready at the end of the year:

- Revised "Blue Book" and "Red Book" (section tables and resistances)
- Introduction to the Eurocodes
- Loading guide
- Worked examples
- Concise guide for building design
- Multi-storey frame guide
- Student worked examples
- Bridge design guides (2008)

Work is also underway to provide concise advice on connection design.
Guidance is already available at **www.access-steel.com** (see box)



www.access-steel.com

Already online:

- Worked examples
- Tedds Lite examples
- Case studies
- Harmonised guidance on steel design

What next?

Look out for news on the publication of important National Annexes—they will be publicised in New Steel Construction.

Over the coming months, more articles will be devoted to explaining the Eurocodes. Examples and guidance can already be found through the Access Steel website, including interactive worked examples.

Eurocode courses are already available from the SCI – see **www.steel-sci.org/courses.** Half day overviews, two-day and evening courses are available.

The BCSA will also be organising events such as the joint event with TWI to discuss pr EN 10990 on structural fabrication to be held on 23rd May 2007.

Corus will be organising road show events across the UK in 2008. These will be announced in New Steel Construction nearer the time.

Committee tailored for success

Geoffrey Taylor

As Chairman of the BCSA's Marketing and Member Services Committee for 14 years Geoffrey Taylor has had a ringside view of the growth of the association and the phenomenal success of the constructional steelwork sector that accompanied it. He tells Nick Barrett about some of the highlights.

The past twenty years have been a period of unprecedented success for structural steelwork, and the sector can fully justify today's confidence that the market will continue to respond positively to the winning blend of quality product, service and technical back-up. That is the confident outlook proposed by Geoffrey Taylor, Marketing Director of Caunton Engineering as he hands over the reins as Chairman of the Marketing and Member Services Committee.

As Chairman for 14 years Geoffrey has a better insight than many to what created the success. He remains a committee member and is as passionately committed to steel as he has ever been. He has spent the largest part of his working life in marketing in the constructional steelwork sector, with firms like Watson Steel where he was Sales and Marketing Director, Graham Wood Structural, Tetbury Steel and now Caunton Engineering.

'The first thing to point out is that although the committee is often referred to as "the marketing committee" our task was not to market steel, but to market the BCSA to steelwork contractors and fabricators,' says Mr Taylor. Fourteen years ago of course the sector was reeling from the impact of the worst post war recession the construction industry has suffered. Clients themselves were folding, and main contractors as well as specialists were going out of business as recession gripped. The 1980's was boom time, with steelwork sales reaching 1.4Mt a year – recession slashed that almost overnight to 800,000t. Prices were in freefall – holding prices up meant no work, but cutting them to market levels was commercial suicide for some. Painful times indeed.

'In the 1980's a lot of people in the steelwork sector went bust.' remembers Mr Taylor. 'But it is noticeable that throughout the 1990's hardly anyone has gone under among steelwork contractors. We don't make the old mistakes any longer.

"In the 1990's hardly anyone has gone under among steelwork contractors"

'We couldn't force companies to behave in a commercially sensible manner, and in that market even the best advised could still have gone under, but the lessons of the recession were learned and today members seem to be on a much firmer footing.

'As a result the potential tender list for a steel framed building will be very healthily long, whereas there will be only a very few tenderers to select from for a concrete frame.'

Not all steelwork contractors are BCSA members today, but almost all are, which is one mark of the success of the committee. The committee has been responsible for several notable marketing innovations.

Below: Steel has been used on a number of high profile projects in London such as the Millennium Dome.

Far right: Steel's dominance in distribution facilities like this one by Caunton Engineering seems assured.

Photos: Beams Gilbert/VIEW

Above: Chek Lap Kok Airport in Hong Kong is one of the many international projects to have been completed by BCSA members.

Corus's forerunner British Steel initially developed an increasing interest in construction; the industry had always been a key market for steel but other client industries like coalmining were in structural decline. The committee became a forum where information and ideas could be exchanged with the country's leading steel manufacturer.

Joint efforts were developed in seminars and advertising which continue to this day. Each of BCSA's four regions sends a representative to meetings. The committee became a forum for what BCSA membership can do for members, which meant informing the world about the work carried out on behalf of members, like lobbying government and its agencies, representation on technical committees, holding weekend educational seminars, holding an annual national dinner, publishing research, providing health and safety and technical advice. Mr Taylor is particularly proud of the efforts made towards promoting steel to schools and students.

In 1990 the White Book was developed, to list for the benefit of the outside world what member's capabilities were and what the industry as a whole could achieve for clients. 'This has been a great success;' he says. Launching magazines like New Steel Construction to spread the benefits of steel among designers has been another initiative of the committee.

'Constructional steelwork is now a very efficient, very slick industry. Three-dimensional modelling has spread quickly among members, which shows that we are receptive to advances in technology that increase our productivity and effectiveness. Three-dimensional modelling came of age in 1992 when I started as chairman of the committee, which was a big breakthrough, as was CNC manufacturing. Just in time manufacturing is another major area of progress.

The machines from manufacturers like Kaltenbach, Ficep and Peddinghaus have also been a great help. It costs about £500,000 for just one of these machines today, which is an effective barrier to entry to those who might not be prepared to be there for the long haul. As a result of major investment in all this sort of equipment we have cut lead times in half. We moved from being a craft based to being a high tech industry very quickly.'

Mr Taylor is proud that very few companies that could be members of BCSA fail to recognise the benefits and join. 'There is no major steelwork contractor today which isn't a member.

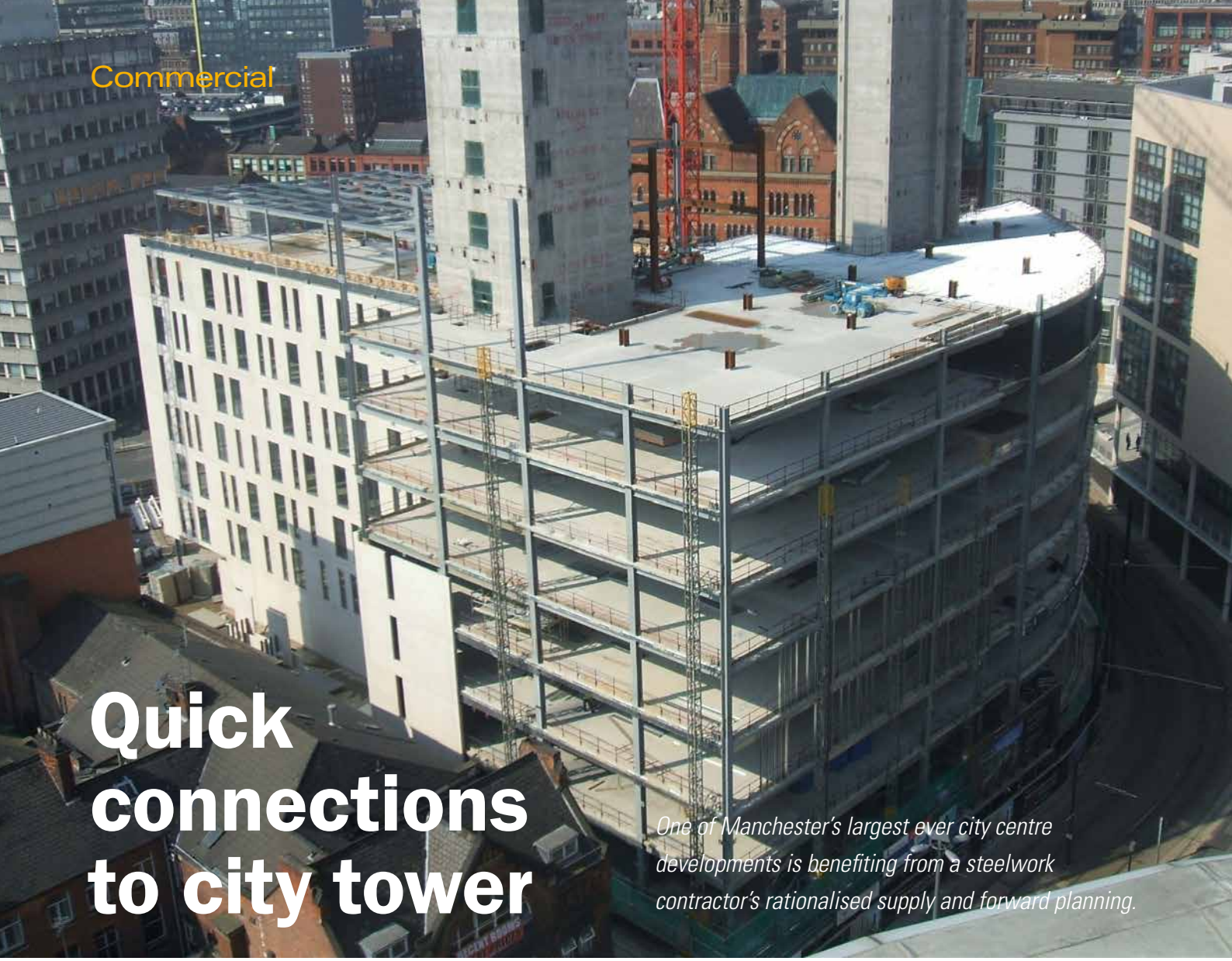
'At the risk of tempting fate, we can safely say that there are no clouds on the horizon for structural steelwork or the BCSA's members. Nobody can predict recessions of course, but that would affect the entire construction industry and not the position of the steelwork sector within it.

"There is no major steelwork contractor today which isn't a member."

'Some 60% of our business is in the industrial sector and this looks rock firm. Our market share has shot up and is at record levels so this is perhaps a good time to take a step back and let someone else take the reins.'

He stresses that he sees the committee as part of the industry's success story, although he modestly rejects the view that it was a cause of it:' We have been a supporter of the success, not a leader of it. We have been a forum where some ideas were either first proposed or were discussed and developed.

'It was an extremely interesting 14 years and I am sure my successor, Andy Holmes of Westok, will be able to report continued success for the constructional steelwork sector after his term of office.'



Quick connections to city tower

One of Manchester's largest ever city centre developments is benefiting from a steelwork contractor's rationalised supply and forward planning.

FACT FILE
Three Piccadilly Place, Manchester
Main client: *Argent Development*
Architect: *Weedon Partnership*
Structural engineer: *Tier Consult*
Main contractor: *Carillion*
Steelwork contractor: *Rowen Structures*
Steel tonnage: *1,650t*

Once complete, the eye-catching Piccadilly Place development will be a landmark scheme as well as the first view many visitors to Manchester will get when leaving the main railway station.

Situated directly opposite Piccadilly Station and linked to the terminus by a new footbridge, the overall project has two phases. The first, consisting of a hotel and office block has now been completed, with phase two under way and scheduled for completion in 2009.

This latter phase will see three towers - known as 3, 4 and 5 Piccadilly Place - constructed on top of a three level concrete car park. Work on number 5, which is a 10-storey residential tower has just started and number 4, an eight storey commercial tower will start shortly.

However, 3 Piccadilly Place, a steel-framed 12-storey office development will be the first part of this sector to be completed. It is currently being erected by Rowen Structures and steelwork is scheduled for completion in June.

The structure is stepped, with one area rising to 12 levels and the other segment having seven floors. Overall the building will offer 20,000m^2 of floorspace.

This is the tallest of the three buildings and its height is one of the reasons why it is being built with steel.

Robert Harmston, Project Director for Tier Consult, explains: "The concrete car park has been designed to accept three structures, but in order to keep the loads down and therefore the basement columns manageable it was decided that the highest building would be steel-framed."

During construction of the car park holding down bolts were cast into the tops of the concrete columns to accept the structural steelwork and aid the erection programme.

Steel was chosen because of the need for long spans and its speed of construction.

Carillion Project Manager Eugene McQuaid, says steel was also chosen because of the need for long spans and its speed of construction.

For the steel-framed building's overall stability three concrete cores are of utmost importance. "They provide the structure's permanent stability, consequently there is very little horizontal bracing, except for a little in the roof top plant areas," adds Mr McQuaid.

The car park and concrete cores were complete by the time Rowen began steel erection in November 2006.

"The car park underneath dictates the grid pattern for the upper levels," says Andrew Henstock, Contract Manager for Rowen Structures.

Left: The steel-framed 3 Piccadilly Place will be the tallest building in the scheme.

"And it's quite an irregular pattern."

In order to maximise their time on-site and make the programme as cost effective as possible, Rowen's involvement in the project also began well before steel erection started.

As well as designing the steel frame, the company also specified a series of plates to be embedded into the concrete cores. Once the cores were cast the plates had fins welded onto them and these connected to the structural beams.

There are a lot of steel connections to concrete, and once the cores were finished a survey was conducted to make sure all the embedded plates were in their correct positions and able to accept floor beams.

A series of plates was specified to be embedded into the concrete cores. Once the cores were cast the plates had fins welded to them and these connected to the structural beams

David Shipley, Rowen's Project Designer, says: "This forward planning saved us a lot of time and work. The alternative would have been to drill bolts into the concrete which is very time consuming.

"We've used this method frequently over the past few years and it's very effective, especially on multi-storey buildings as it gives an immediate fixing for the steelwork."

A number of other considerations were taken on board at an early stage as Mr Henstock explains: "We wanted to use cherry pickers, so the design was developed to accommodate that and a fairly common loading has allowed us to rationalise the steel sizes."

By rationalising the steel, deliveries to site have been simplified, as there is little room for setting down. The site is surrounded by roads and tram lines on two sides and steel has to be erected as it is delivered.

Close cooperation with the concreting team didn't end with the core structures. The whole erection programme involves a sequence of cooperation. Mr McQuiad says each floor is completely erected, decked and has its concrete poured in a four week cycle.

"We've split the site into four sections, with the concreting following on behind the steel erection. When two phases have had their steelwork completed, the concrete slab is poured and when it has cured it is then ready for the cherrypickers to work on top of it to start the erection process all over again," says Mr McQuiad.

In this sequence steel erection has progressed almost unhindered, except for some time lost during stoppages due to strong winds.

"Steel is a quick material to build with and we've got most of that time back now," adds Mr McQuiad.

All of the structure is predominantly erected on a 7.5m x 7.5m grid plan, but this changes to a 9m x 7.5m grid and even a 10.5m x 7.5m grid in places.

"Although the grid pattern changes it is constant right up through the structure," says Henstock. "This helped with rationalising the steel."

Structural beams are typically 305mm deep sections, although this changes to 500mm deep members on the second and fifth levels. "Stiffer support was needed to support the cladding," explains Mr Henstock.

One area, however, did require two larger column sections than elsewhere on the project. Close to one of the cores and adjacent to a number of service voids two 356mm x 406mm columns were installed to take the extra loading.

The initial erection programme saw all columns installed in 13m lengths, taking in the first three levels and thereafter all sections were spliced at every other floor, which required 8m-long sections.

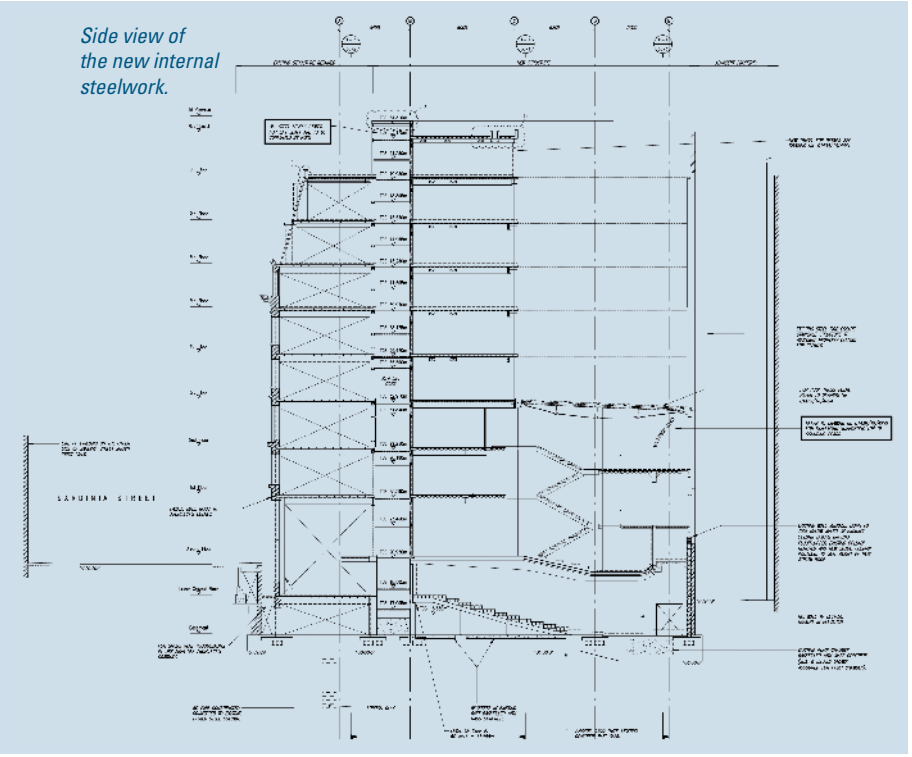
"There are also a lot of narrow service zones between the floors and to accommodate this we had to use some heavy but shallow columns as beams," says Mr Harmston.

When steelwork is completed in June, fit-out will continue until the year's end and the structure is expected to be finished in early 2008.

Above: One complete floor is erected every four weeks.

Below: Steel deliveries are kept to a minimum as the site is surrounded by roads and tram lines.

The ground level truss being lifted into place.



Side view of the new internal steelwork.

Steel solutions for academia

An innovative hanging floor arrangement and modular cores, all behind a retained facade, have all helped to keep a major London academic project to schedule. Martin Cooper reports.

The latest central London construction project to incorporate an historic retained facade is the 12,700m² new academic building for the London School of Economics and Political Science (LSE).

Originally built in 1912 and situated between Kingsway and Lincoln's Inn Fields, the Portland stone clad steel-framed structure has nine-storeys plus basement and is U-shaped in plan.

As well as retaining the building's facade, the construction plans incorporate a larger floorplan, an atrium taking up some of the open area of the U-shape, a roof pavilion which will add another floor to the structure, and a revamped forecourt area.

The overall scheme will eventually provide four new lecture theatres, 18 classrooms, research facilities and academic offices on the upper floors.

Main contractor Osborne started its work on site in early 2006 and demolition - carried out by McGee - began in September and lasted for approximately four months.

The demolition work essentially removed all the existing floors, including the structure's two basement levels, while retaining the facade and the external bay of floor structure around the perimeter of the building.

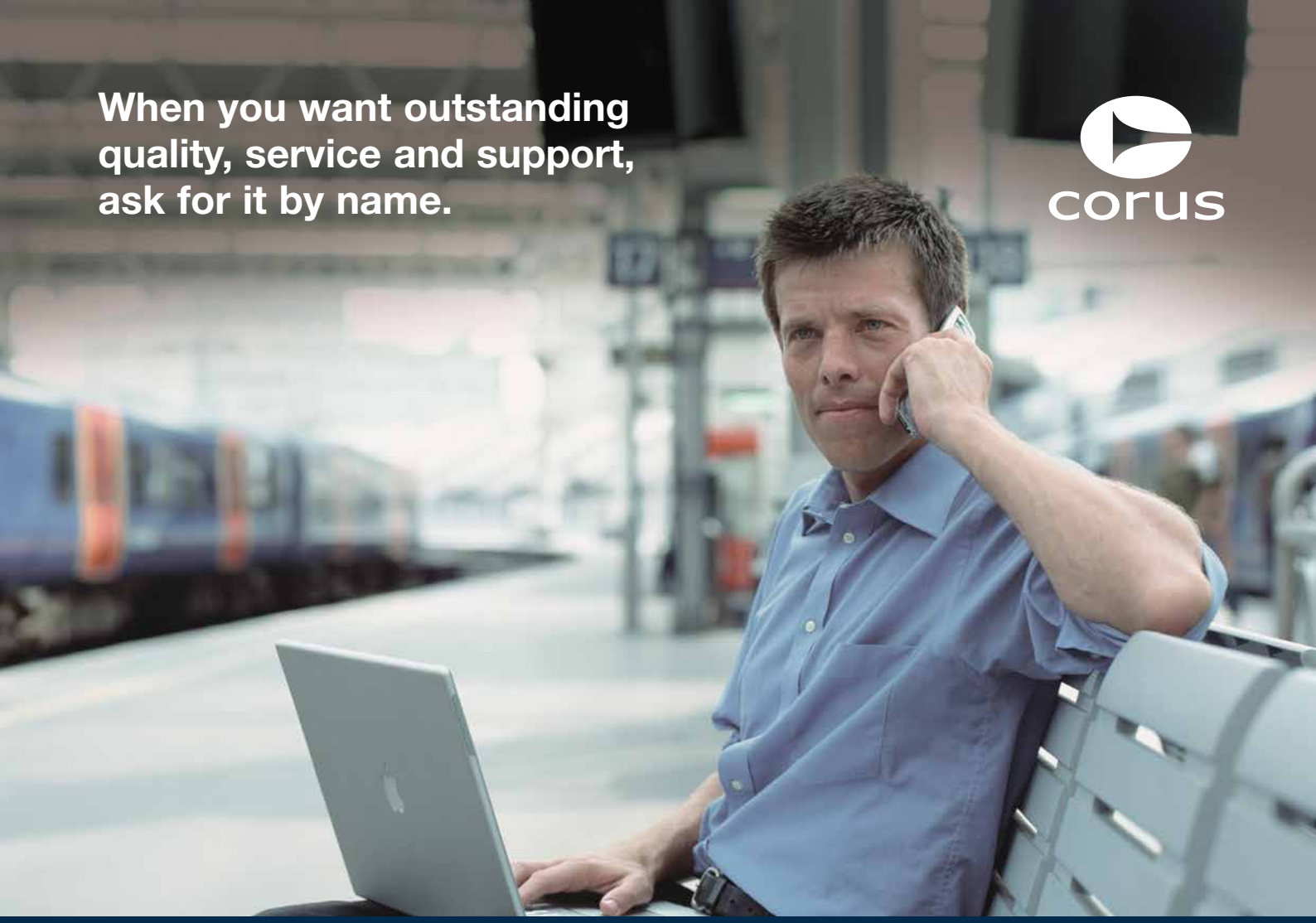
Retaining some of the existing floor space helped stabilise the facade during the works, but this also meant steelwork contractor Bourne Steel was needed on site from an early stage.

Brendan White, Bourne Steel Divisional Manager, says his company was involved during the demolition process by installing early steelwork to support the retained 7.5m x 3.3m grid bay.

"As each floor was demolished we had to erect new permanent steelwork"

"As each floor was demolished we had to erect new permanent steelwork and we were basically in and out at this stage," says Mr White. "Once demolition was over, however, our presence on site increased significantly as we then began erecting the new build elements of the job."

Interestingly, during the demolition process, McGee also installed two new lift cores using Corus →



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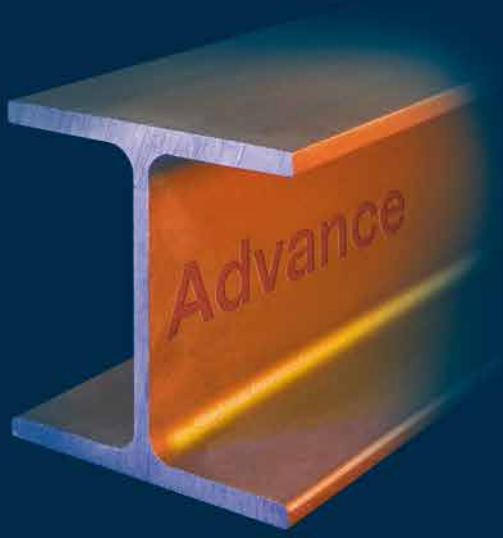

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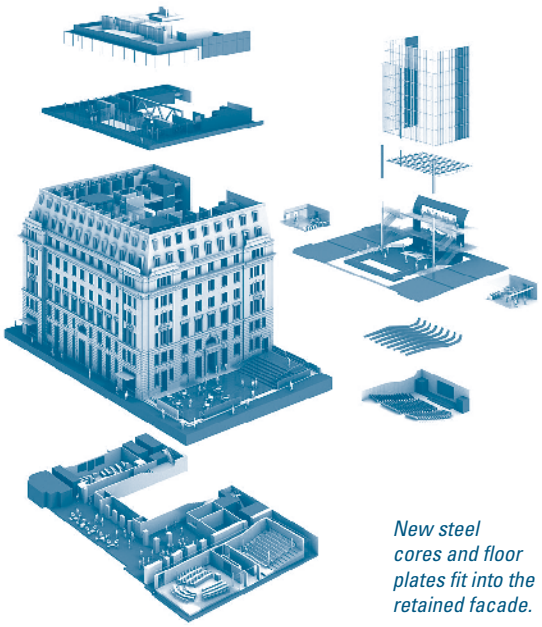


New steel cores and floor plates fit into the retained facade.

Above: One bay of original steelwork has been retained along three sides of the building.

FACT FILE
New academic building for London School of Economics and Political Science (LSE)
Main client: *LSE*
Architect: *Grimshaw*
Structural engineer: *Alan Baxter & Associates*
Main contractor: *Geoffrey Osborne*
Steelwork contractor: *Bourne Steel*
Demolition contractor: *McGee*
Project value: *£46M*
Steel tonnage: *450t*

Bi-Steel's Corefast system (see box for the full story).

Working behind a retained facade presents a number of challenges for contractors. Mr White says getting all steel members into the site had to be done by tower crane and consequently all sections were kept to a minimal length and weight.

Marrying the new steel elements to the original steelwork was another challenging aspect of the project for Bourne. "Our connections to the existing riveted steel were very labour intensive as the old plates had to be washed before being drilled," explains Mr White.

One of the main objectives of the scheme was to create more open plan floor plates for the building. This has been achieved by retaining the majority of columns from the existing bay and then hanging the majority of new floor plates from a roof level transfer truss. This innovative solution also minimised the number of required new columns.

This configuration of hanging steelwork also allows the main ground floor area and an adjacent lecture theatre at lower ground level to be clear of internal columns.

The 15t roof level transfer truss is 17.5m long and is supported on two CHS columns which extend right through the new build section of the building. These columns are 559mm diameter at the lower levels, decreasing to 508mm diameter further up the structure. At basement level these two columns are founded on new piles.

Kevin Rooney, Project Structural Engineer for Alan Baxter & Associates, says the roof truss arrangement allows for flexible floor plates as well as minimal internal columns.

"All of the floors down to the third level are hung from the bottom cord of the truss by two steel hangers which are each made up of two 100mm x 50mm solid steel bars," adds Mr Rooney. Further down the structure, separate SHS hangers connect to the second and first floor levels.

Bourne had to use some intricate temporary works to install the hangers. They were craned into the site →

Quick cores save time

The original building layout contained two masonry staircase/lift shafts and these were dismantled by McGee during the demolition works. The initial construction plans envisaged the replacement with similar sized concrete lift cores.

Mark Makinson, Osborne's Site Manager, explains that as McGee were contracted to install new cores they suggested the Corefast option as a quick and efficient alternative.

Corefast is an off-site, modular technique for the rapid erection of structural cores. The system makes use of Bi-Steel, which comprises two steel plates connected together by bars to form panels. When erected on site the void between the panels is filled with ready-mixed concrete to create a high performance construction.

"Ordinarily, it would have been the steelwork contractor which would have erected the steel cores, but as the specification changed from concrete at McGee's suggestion they did the work," says Mr Makinson.

Speed was critical for this project and both cores were erected in just over two weeks by using the Corefast modular system.

"With concrete we were looking at a 14 week programme," comments Mr Makinson. "By using Corefast, we were able to meet the client's ambitious programme requirements."

Robert Fisher, Corus Bi-Steel Business Development Manager for Corefast, says the fact that McGee did the installation highlights the product's simplicity of erection.

"The core design was ours," explains Mr Fisher. "The modular sections were delivered to site in single storey heights and they were all bespoke units to suit the site layout."

Each storey height was erected from two sections: one a F-shaped unit and the other a C-section. These elements, which weighed no more than 4t each, were craned into the project individually and then bolted together.

Commenting on the advantages of using the Corefast system, Mr Makinson adds, the steel units were specified in 216mm thicknesses. This is the thinnest Corus produces, but as steel is stronger than concrete a thinner core wall was installed, increasing the net internal floor area.

Mr Makinson comments that he was also impressed with the construction tolerances of the Corefast units, which helped with the speed of installation.

"Another advantage of the Corefast method was that we were able to have other trades working during the installation process, says Mr Makinson. "If we'd have gone down the reinforced concrete core route, not much else could have gone on while they were being constructed."

Below and below middle: Four columns have been removed, using a by-pass frame, to create a more open-plan area.
Below right: The new ground level walk-through area.

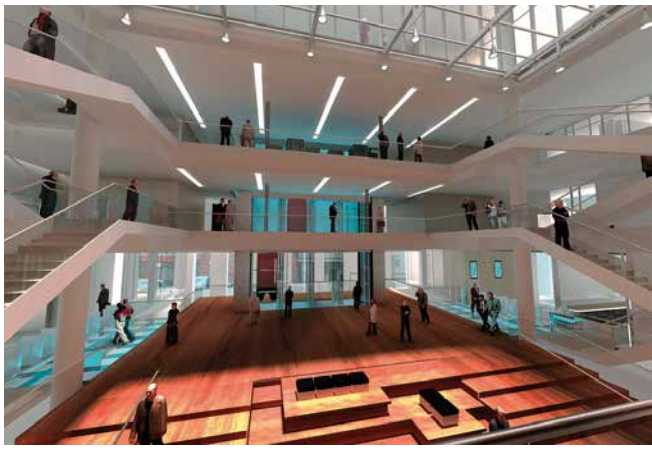
in 16m lengths attached to a 'strongback' device which prevented any damage during transit. This device was detached from the hanger once they were in place and then used for the next section.

The new atrium measures 13m x 16m, extends upwards from the third floor level, and will incorporate a visible scenic lift. To support its glass cladding eight 13m-wide bowstring trusses will be installed. Below third level the entire footprint is used by the building, with the ground level containing a large public walk-through area above the basement theatre.

Meanwhile, to add to the flexible floor areas and create a more open plan feel, four existing columns - which are structure height - have been removed from every level. Transfer beams have been inserted above these new grid plan voids and the adjacent columns have been strengthened by concrete encasements to take the extra loading.

Another 6t steel truss has also been installed at ground level and this supports eight 19m long pre-cast concrete ribs which form part of the roof structure to the basement level lecture theatre.

All those involved in the project say the steel elements of the project have kept the job to schedule, as time is of the essence. The new LSE building is due to open for the Autumn term in 2008.



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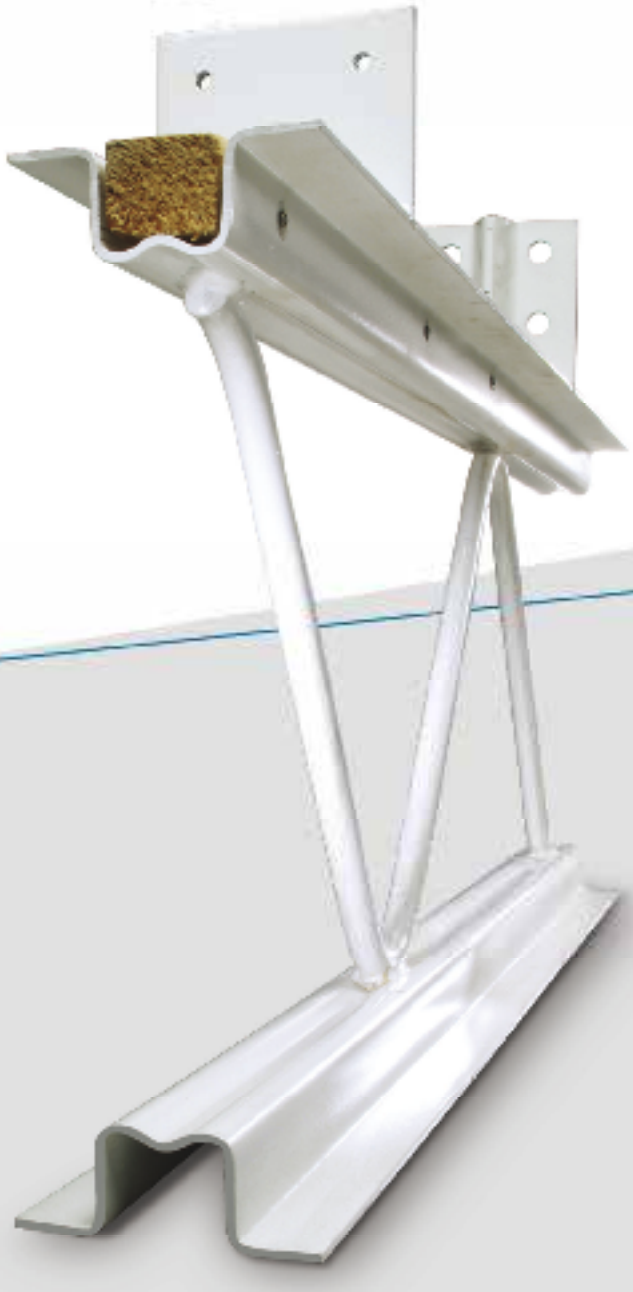

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ONE STEP AHEAD.

Above: London's winning Olympics bid relied heavily on the sustainability characteristics of steel, such as demountability of structures after the Games.

Steel and Sustainability

Sustainability has become a key driver for companies and organisations of all types in the past few years. Steel has always had strong sustainability credentials, the main aspects of which will be highlighted in a series of articles in NSC over coming months. Nick Barrett starts the series with an overview.

Sustainable development implies a balance between the social, economic and environmental benefits that any development can deliver. The Olympic Delivery Authority, for example, shares this view of sustainable development, but also states that we should never lose sight of the need to deliver projects on time and to the agreed budget.

Right: Steel from Corus's Teesside Meltshop was recycled for use in projects such as the Swale Crossing in Kent.

The most obvious sustainability strength of steel is its ability to be recycled and reused. Recent environmental legislation like the landfill tax has spelled out government's impatience with traditional practices of simply dumping waste, including construction waste, in landfills. Even before sustainability and the environment become such prominent political issues most steel was recycled – 94% of all steel construction products are either reused or recycled when buildings are demolished. It is estimated that 99% of structural sections are recycled or reused.

It is estimated that 99% of structural sections are recycled or reused

It is estimated that an amount equivalent to some 40% of total world steel production is recovered and recycled annually. Steel can be recycled over and over into new products with no reduction in its

The UK's steel framed buildings and other structures can be viewed as a strategic and valuable material resource that will be reclaimed by future generations for reuse or recycling.

Left: Shed specialists such as Barrett Steel Buildings are now able to measure their carbon footprints.

inherent properties. The UK's steel framed buildings and other structures can be viewed as a strategic and valuable material resource that will be reclaimed by future generations for reuse or recycling.

Contrast this with alternative framing materials like concrete, whose recovery is only economically justified because of the value of the steel reinforcement. The reinforcing steel is recycled while the concrete has to be crushed and downgraded for use as fill materials.

In terms of reuse the steel framing components within a building can be seen as a kit of parts, which means that when a building is no longer required in its current form, the structural elements can be retrieved and then reused.

All steel construction products are manufactured offsite, from which flows a wide range of sustainability benefits. For example, workers face far fewer journeys to work than would be needed if on-site produced alternatives were used. There is less need for construction workers to spend extended periods working away from home, with a long journey tacked onto the start and end of each working week.

As constructional steelwork is manufactured in factory-controlled conditions, there are obvious benefits to the health and safety, and social cohesion of the workforce within the community.

Careful structural design minimises the steel used for any particular purpose. Steelworks and fabrication plants operate on a waste minimisation basis; what little waste is generated can be easily retrieved and recycled. By its very nature offsite manufacture increases quality but also reduces the amount of on-site waste generated, which can be difficult to recover and reuse.

Constructional steelwork is routinely delivered to site on a 'timed' basis, which not only minimises the space needed for materials storage on site, but also gives the opportunity to avoid deliveries during periods of road congestion. In addition, compared to concrete construction there is a vastly reduced number of deliveries to site using heavy vehicles. The communities around a development will as a result benefit from a reduction in noise and dust generated by these delivery activities.

Steel framed buildings are efficient stores of thermal energy, containing sufficient mass in their lightweight floor slabs to allow designs to maximise fabric energy storage. This means excess energy can be absorbed during the day and expelled at night, which reduces the need for energy to be used to heat and cool buildings.

The flexibility of steel has 'future proofed' many buildings, allowing for internal layouts to be easily reconfigured for changing uses; this means buildings that would otherwise have been demolished enjoy extended lifetimes. Steel's high strength-to-weight ratio enables structural and resource efficiency, allows foundations to be smaller and means buildings can be extended vertically without overloading the foundations.

The inherent speed and predictability of steel construction means that construction programmes can be reduced and there are fewer delays due to the weather. This has major implications for the financing of a project and also when the client can begin to see a return on his investment.

The steel sector has developed a sustainability charter that lays out a coherent strategy of prioritised sustainable development objectives, against which progress is annually reviewed. The British Constructional Steelwork Association has created a Sustainability Charter for steelwork contractors under which signatories commit to a wide range of sustainable practices across their operations and agree to an annual audit of their performance against the commitments made.

Below: Steel's lightness and flexibility was demonstrated on the Empress State Building in London which had three floors added during a renovation programme that didn't overload the existing foundations.

Quick treatment for new hospital

A tight construction programme and the need to minimise disruption to the local community led to the decision to use steel for a new hospital in Glasgow. Martin Cooper reports.

The new Victoria Hospital in Glasgow forms part of Phase 1 of NHS Greater Glasgow & Clyde's modernisation programme which will radically improve healthcare facilities across Scotland's largest conurbation.

Construction at the Victoria Hospital site commenced early last year and completion is set for 2009. The new 41,500m^2 hospital, which is situated on former playing fields opposite the existing Victoria Infirmary, will consist of three functioning levels on top of a covered car park.

The project also includes roof top plant rooms and an adjacent, stand-alone, 1,000m^2 energy centre building.

Project architect HLM says the overall design is the result of extensive site analysis and based on the concept of creating a 'hospital in the park' which maximises the creation of a high amenity therapeutic environment for patients and staff in a mature landscaped setting.

This desire for a relatively peaceful setting also influenced the need to keep construction activity in general to a minimum, bearing in mind the close proximity to an existing hospital.

Stephen Muir Project Director for Balfour Beatty Construction, says the surrounding residential properties as well as the Victoria Infirmary led to the decision that the new hospital and energy centre would both be steel-framed.

"We were following our 'good neighbour' policy, which is an important scheme at Balfour Beatty," explains Mr Muir. "With steel there is always less impact on the surrounding area, such as less noise and dirt, and fewer truck movements."

Balfour Beatty wants to keep deliveries to a minimum as the site is surrounded by busy south Glasgow roads. Using concrete on a project of this size would have meant materials turning up on site nearly every hour.

"Steel also lends itself to off-site fabrication and a relatively short erection period compared to other materials, which reduced pressure on our extremely tight construction programme and meant on average only two steel deliveries a day," adds Mr Muir, who is a self-confessed fan of steel construction.

To emphasis just how tight the construction programme is Mr Muir adds: "The 124 week programme to deliver a £100M project is a challenging one."

"The 124 week programme to deliver a £100M project is a challenging one."

Steelwork erection commenced on 26 February this year, seven weeks ahead of the construction programme. Prior to this, Balfour Beatty had undertaken some major preparatory works which included leveling a sloping site by removing 63,000m^3 of overburden.

An extensive piling operation also took place with 386 bored piles, each with a pile cap, being installed to accept steel columns.

The works followed a sequential pattern around the site from east to west and then south. The piling programme followed on behind the earthmoving and once an area had been leveled and piled, steelwork contractor Severfield-Reeve was able to begin erection.

Severfield-Reeve is Balfour Beatty's supply chain partner, engaged to deliver its PFI hospital portfolio.

Top left: The hospital entrance is part of a 160m-long crescent facade.
Above: The central atrium has two bridges at second and third levels.

The close proximity of housing led to steel being used.

Below: A sequential programme has meant earthmoving, piling and steel erection takes place at the same time.

Steve Swift Project Manager for Severfield-Reeve, says the project basically follows a 7.8m x 7.8m grid pattern where possible, although as the building is far from square, there are a number of deviations.

The feature element of the project is a 160m-long sweeping crescent facing in a south westerly direction. The facade contains the hospital's main entrance and an attached 800m² open atrium.

"The connections throughout the structure are different and bespoke, especially along the crescent facade," says Mr Swift. "Along this facade they generally have a shallower geometry because of the angle for the supporting beams."

Six open atriums allow natural daylight to penetrate into the inner wards of the building

But in general, Mr Swift says even the connections and the shape of the feature facade weren't that challenging for a modern day design office. "In the days before CAD it may have been more of a challenge," he concedes.

Severfield also erected two steel bridges that span the central atrium at the second and third levels. "We also installed a large amount of feature steelwork around the perimeter of the atrium to accept the glazing," adds Mr Swift.

The entire hospital building contains a total of six open atriums extending upwards from the ground level and these were designed to allow natural daylight to penetrate into the inner wards of the building.

These open areas also interrupt the otherwise constant grid plan, but Mr Swift says the steelwork supply has been rationalised to make work easier and quicker. Column sizes are typically 305mm x 305mm, while beam sizes start at 203mm deep members with 762mm deep beams being used nearer the atrium areas.

Structural engineers for the project Faber Maunsell, says the pre-construction design was particularly challenging. The design co-ordination of such a highly serviced building with many rooms, some of which will house specialist equipment, such as MRI scanners, has taken a high degree of skill and effort, on the part of all those involved.

Vibration could have been an issue and the scanners posed another challenge, due to their operational sensitivities. Faber Maunsell and Severfield-Reeve's diligence produced a design that incorporates all of the Health Board's specifications.

Robert Calderwood, Chief Operating Officer for NHS Greater Glasgow & Clyde's Acute Division, said "The development of this new hospital will signal a new era in patient care and comfort. It will be equipped with state-of-the-art imaging machines and advanced day surgery theatres. Modern consulting rooms, airy waiting rooms and secure underground parking will create an attractive and welcoming environment, totally changing the patient experience for the better."

FACT FILE
The new Victoria Hospital, Pollokshields, Glasgow
Main client: *Glasgow Healthcare Facilities under a PFI contract with NHS Greater Glasgow & Clyde Health Board.*
Architect: *HLM Architects*
Structural engineer: *Faber Maunsell*
Main contractor: *Balfour Beatty Construction*
Steelwork contractor: *Severfield-Reeve*
Project value: *£100M*
Steel tonnage: *2,800t*

Photos: David Barbour/BDP

Up and running at Aintree

Above: Each stand is topped by a huge 18m cantilever roof.

A stunning steel-framed twin grandstand, the centrepiece of a two-year redevelopment scheme, was officially opened for last month's world famous steeplechase.

FACT FILE
Aintree Racecourse redevelopment, Liverpool
Main client: Jockey Club Racecourses
Architect & structural engineer: Building Design Partnership
Main contractor: Laing O'Rourke
Steelwork contractor: Watson Steel
Project value: £35M
Steel tonnage: 1,320t

The Grand National is said to be the world's most watched horse racing event with close to 600M people around the globe viewing it every year.

This year's meeting - held from April 12-14 - benefited from the completion of a £35M redevelopment programme which has a stunning new grandstand as its centrepiece.

The overall redevelopment work was split into two phases to accommodate last year's Grand National. No cancellation of this hallowed event was permitted, so the project team initially came on site in 2005 and wrapped up phase one before the 2006 event. They then came back to do phase two and finished this stage in time for April's meeting.

Above: The new twin grandstand overlooks the finishing post.

Phase one of the project included a new weighing room, parade ring, stables, pre-parade ring, a steel-framed media centre and a pavilion. In order to maximise the tight timescales the first phase of work also included groundworks and piling for the new grandstand's foundations.

Peter Riley, Project Manager for Watson Steel, says his company supplied holding down bolts which were cast into the pile caps and these were then covered over to allow temporary structures to be erected for the 2006 event. Once last year's race meeting was over and the temporary buildings dismantled, the steelwork erection was able to begin immediately.

"This saved us a couple months of work as all the preparatory work was done and steel columns could be erected on to the bolts as soon as we came back on site last May," explains Mr Riley.

The new Aintree grandstand, which is without doubt the crowning glory of the redevelopment programme, is in fact two identical mirrored structures linked by a central pavilion that includes bar areas.

Built adjacent to the existing Queen Mother Stand, the new structures, called the Lord Sefton Stand and the Earl of Derby Stand respectively, are located on a bend in the course close to the finishing post.

Both stands provide three tiers of premium viewing facilities. A ground floor terrace can hold 1,400

punters, while above this there are two levels of seating. Each floor also contains numerous eating and drinking outlets, betting facilities and hospitality suites.

In total, the grandstand has added an additional viewing gallery for 2,800 race-goers on steppings at ground level, seating for another 1,580 punters, plus 32 disabled spaces and permanent corporate hospitality facilities for 2,288.

Joining the two grandstands is a concrete toblerone-shaped pavilion named the 'Saddle Bar' containing a bar, lifts and stairs. The ground floor of this three level structure features a tunnel to allow horses access to and from the parade ring situated to the rear.

Public access to the upper seating areas of the stands is from the Saddle Bar via four steel bridges, two 16m-long bridges linking into the second level of seating and another two 14m-long bridges linking to the upper level. Access to the standing terraces is via the front of the grandstands at ground level.

The steel bridge structures were fully assembled and concrete decked at Watson's Bolton facility and delivered to site as complete units. They were then individually lifted into position towards the end of the construction programme.

A major feature of both grandstands are the large feature 18m cantilever roofs which required some intricate design work to accommodate their complicated geometry and haunch.

Building Design Partnership's (BDP) Project Engineer, Phil Simcock, says the roof required some complex modelling as each grandstand splays out from back to front and is curved along its central axis.

"The original vision and design for the stands was a jockey's cap," explains Mr Simcock. "Viewed from the side this becomes evident and the cantilever roof represents the cap's peak."

"The original vision and design for the stands was a jockey's cap."

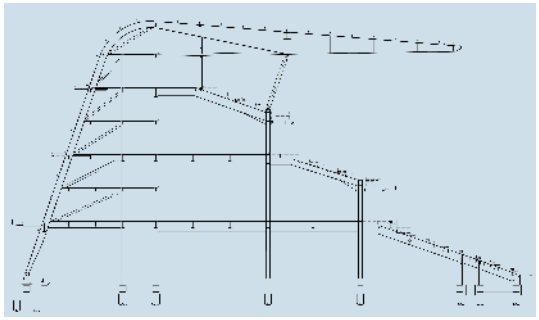
The roofs were erected almost simultaneously and both feature a large 34m-long, 2.2m deep transfer girder which sits horizontally across the stand. This large member is supported by perimeter raking columns and is situated far enough back on the roof's plan so as not to hinder any sight lines.

The transfer girder also incorporates a curved top flange to accept the roof top purlins and also supports the four cantilevered plate girders below, each 29m-long in total and up to 2m deep.

Mr Simcock says: "The roof went through a number of design changes early on. But a cantilevering roof was plumped for as it was the most cost effective and architecturally accepted design solution. Because roofs are an extremely prominent feature it was also decided that the steelwork would be exposed."

Below the roof structure the grandstands have been erected with a 10m x 10.5m grid pattern with six lines on the ground level. Because the structure steps back as it rises, every floor has one less grid line.

"Vibration issues due to dynamic crowd loading also played an important role in the design of the stands," says Mr Simcock. "Both vertical and horizontal natural frequencies were required to be modelled and assesed, while the internal hospitality areas have been designed to accommodate events such as dances, which create synchronised dynamic crowd loading."



Left: Each stand features three tiers at the front and six floor levels at the rear.

Below: Rear view of the grandstands.

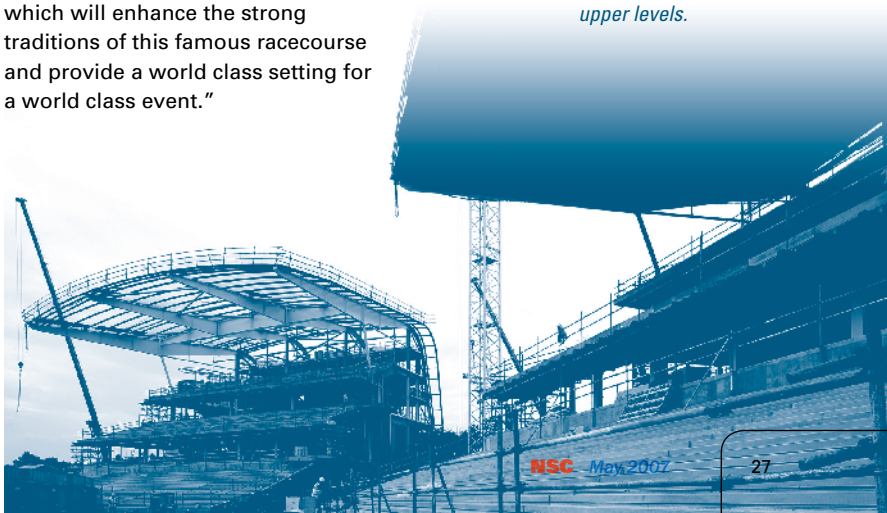
Another challenging aspect for the team was associated with the two seating terraces. Both have pre-cast concrete decks and these slabs overhang the supporting steelwork to form balcony areas at the front of both terraces.

"We had to design some very heavy connections to fasten back the concrete onto steel plates," says Mr Riley.

"There were some huge torsional forces and the balconies were held back with a combination of steel stubs and Macalloy rods," adds Mr Simcock.

On the finished project, BDP Project Architect Richard Elsdon sums up: "Our design provides race-goers with state-of-the-art facilities which will enhance the strong traditions of this famous racecourse and provide a world class setting for a world class event."

Below: Pre-cast concrete was used for all the terraces and needed some heavy connections to steel plates on the two upper levels.



Overall stability of multi-span portal sheds at right-angles to the portal spans

SCI's Senior Manager for Standards, Charles M King, explains the approach for design of long-span portal sheds.

1. Introduction

As portal sheds become wider and longer, the overall stability of the buildings at right-angles to the span of the main portals becomes increasingly sensitive. This article considers the issue and describes approaches for design for stability in this direction. Figure 1 shows the mode of deformation considered.

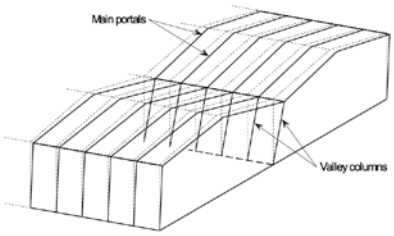


Figure 1: Sway at right-angles to the span of the main portals.

One issue that made the 2000 revision of BS 59501 necessary was the need for rules to ensure the in-plane stability of portal frames. The methods available to ensure the stability of the buildings at right-angles to the main portal frames were not so clearly defined.

2. Stability systems

Every building must have a structural system that provides stability. In BS 59501:2000 clause 5.5 *Portal frames*, clause 5.5.1 states explicitly that frames "should be stabilised against sway out-of-plane" and refers to clause 2.4.2.5. The common structural arrangements are:

- Vertical bracing in the walls and in all of the planes of the valleys. This system gives the simplest method of resisting sway.
- Vertical bracing in the walls + plan bracing in the roof (wind bracing)
- Vertical bracing in the walls + portal frames in the plane of the valleys

There will be plan bracing in the roof to resist wind on the gable ends and to stabilise the portal rafters but it is used only in item 2 above to provide stability in the plane of the valley.

2.1 Vertical bracing in walls and the planes of the valleys

Figure 2 shows a shed with vertical bracing to provide stability in the walls and in the plane of the valley.

2.2 Vertical bracing in walls plus plan bracing in the roof

Figure 3 shows a shed with vertical bracing to provide stability in the walls but no vertical bracing in the plane of the valley. Stability in the plane of the valley is provided by the plan bracing in the roof connected to the vertical bracing in the walls. The plan bracing is commonly formed as a truss in which the chords are the rafters of one portal and the member along the top of the gable wall. It is often found that where the truss "depth" is only one bay, as shown in Figure 3, the truss is very flexible and may be insufficient to stabilise the valley columns. The "depth" of the plan bracing may need to be increased to two (or more) bays of the frame as shown in Figure 4. This plan bracing might develop major additional axial forces in the members forming the "chords". It is possible that the member along the top of the gable wall will need rather more demanding detailing than is commonly provided to avoid having many connections that might allow a significant accumulation of slip.

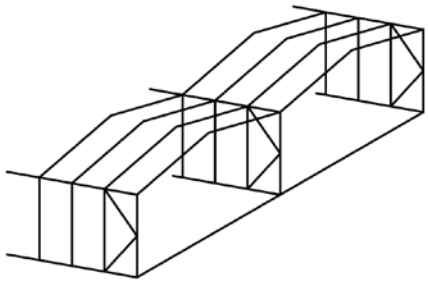


Figure 2: Vertical bracing in the walls and in the planes of the valleys (plan bracing omitted for clarity).

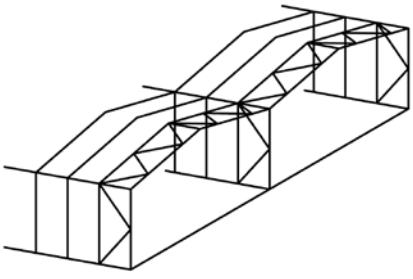


Figure 3: Vertical bracing in walls plus plan bracing in the roof.

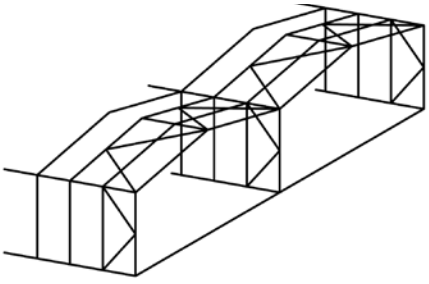


Figure 4: Plan bracing in the roof with 2 bay "depth".

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2.3 Vertical bracing in walls + portals in the plane of the valleys

Portals, often called wind-portals, are used in the plane of the valley if diagonal bracing interferes with the use of the shed. This is shown in Figure 5.

3. Requirements of the stability system

The frames may have a valley column at every portal, or may be "hit and miss" or "hit-miss-miss" frames. Figure 6 shows a section through a typical shed showing the axial load F_v in the valley column which includes the vertical reaction from any "miss" frames in the structure. Figure 7 shows the sway mode that the stability system is designed to resist.

Important features of the stability system are:

1 The stability system has to stabilise all of the columns
2 Stability systems often have relatively low sway stiffness, especially in sheds that are large and high.

The consequences of these two features are discussed below.

3.1 The stability system has to stabilise all of the columns

The stability system has to stabilise the total vertical load in the building, which is the sum of all the axial compression in all of the columns. Therefore, the design loads on the system in Load Combination 1 include the notional horizontal forces from all the columns that are stabilised by the system, including any office areas or other structures stabilised by the main shed. In other combinations, usually there are wind loads. There may also be horizontal forces from cranes and/or horizontal impact forces.

To calculate the internal forces and moments in the stability system, the analysis must be made with the columns supporting the total factored design load including the axial load from the analysis of the main portal frames as shown in Figures 6 and 7. Otherwise, the second-order effects in the plane of the system caused by these vertical loads will not be calculated.

3.2 Some stability systems have relatively low sway stiffness

The forces resisted by the stability system are generally small, so the members are small, resulting in a relatively low stiffness. Because of the low sway stiffness, the designer should expect to account for second-order effects in the plane of the valley frame. Often the design of the main portal frames also has to allow for second-order effects. It is important that where second-order effects arise, they are fully accounted for. This is required by BS 59501:2000 clause 2.4.2.5, Sway stiffness, to which designers are referred by clause 5.5.1. Therefore, if there are second-order effects in two directions, the effects in both directions must be considered.

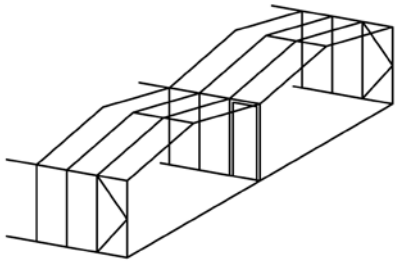

Figure 5: Vertical bracing in walls + portals in the plane of the valleys (plan bracing omitted for clarity).

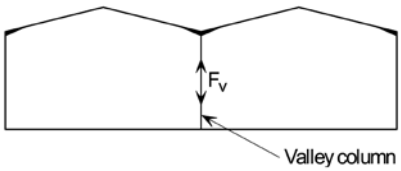

Figure 6: Section showing vertical load, F_v, in valley column.

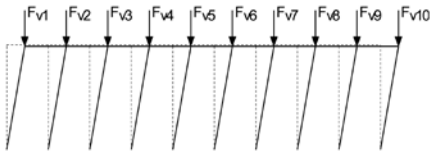

Figure 7: Valley frame sway mode showing column loads F_v.

Large buildings will often have large tonnages of steel in the stability systems. For these frames, it is probable that the most economical structures will be obtained by using second-order analysis software. Indeed, the stability systems will often be so flexible that they will be below the limit of λ_{cr} for which BS 5950-1 allows simplified methods to be used. BS 59501 does not define a minimum

value of λ_{cr} for second-order analysis, but it is recommended that designers should be cautious where $\lambda_{cr} < 4$ and that frames should not have $\lambda_{cr} < 2$. This is because any connection slip or flexibility reduces λ_{cr} below the value shown by frame design software, as also does any plasticity (especially in moment resisting frames), and the frame will collapse at $\lambda_{cr} = 1$ unless there is something else to hold it up.

If second-order software is not available, the designer needs to choose another way to allow for any second-order effects. Guidance on the use of the simplified methods in BS 59501 is given below.

4. Modelling and design

To understand the stability of a building, it needs to be considered initially as a 3D structure, even if it is modelled as several 2D frames. If there is more than one stability system, the horizontal loads should be shared between the systems in proportion to the sway stiffness of each system. The most common example of this is where there is vertical bracing at both ends of a line of columns. If the bracing is the same at each end, only half of the columns are stabilised by each bracing. It might be simplest to model the entire line of columns and all the bracing.

4.1 Vertical bracing in the walls and in each plane of valley-columns

The frame can be modelled as separate 2D frames in which the total vertical load in the plane of the frame must be stabilised by the bracing in that plane.

4.2 Vertical bracing and plan bracing

Where valley columns depend on plan bracing for stability, the flexibility of the complete system of vertical bracing plus plan bracing must be included in the calculation. If the vertical and horizontal bracing are analysed as separate models, the lateral deflection of the vertical bracing must be added to the lateral deflection of the plan bracing.

4.3 Portals in each plane of the valley columns

As in the case of vertical bracing in each valley plane, the structure may be modelled in 2D provided that the advice above about calculating second-order effects in the plane of the valley frame is followed (ie including all the loads in all the columns when calculating the internal forces and moments to allow for the destabilising effects).

It is recommended that the main portal frames are analysed without the valley portals because in the normal orientation, shown in Figure 8, the valley portal leg has insignificant effect on the stiffness of the main portal valley column in the plane of the main portal.

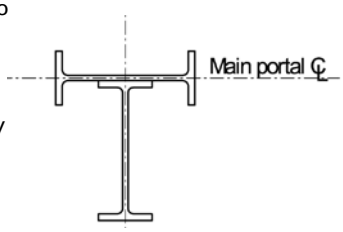

Figure 8: Valley column and valley portal leg.

Where the main portal valley column and the valley portal leg are welded together, they will act as a compound member. In the plane of the valley portal, this has a significant effect on the column stiffness which may be worth calculating to obtain the maximum column stiffness.

Because many large sheds are very high, base stiffness is often very helpful in providing stability to the frame. Guidance on base stiffness is given in BS 59501:2000 clause 5.1.3.

Plastic design is not recommended for these stability frames because

1 in frames supporting major loads on the valley beam, such as "miss" frames, there is commonly significant sway after formation of the first plastic hinge
2 extensive plasticity reduces the sway stiffness
3 special care is needed to avoid forming hinges at the beam-column connections, which do not have adequate ductility.

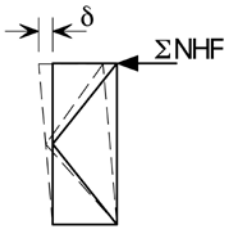

Figure 9: Elevation of sway mode showing vertical bracing.

5 Simplified methods to allow for second-order effects

5.1 Vertical bracing in the walls and in each plane of valley-columns

The stability can be checked using BS 59501:2000 clause 2.4.2 as if each 2D frame is an ordinary braced frame. Figure 9 shows an elevation of the bracing system. In the figure, ΣNHF denotes the sum of the Notional Horizontal Forces from the columns in that plane that are stabilised by the bracing system shown. The figure also shows the deflection, δ, at the top of the columns arising from the Notional Horizontal Forces.

The procedure is as follows:

1 Calculate the total notional horizontal force from the total vertical load in the plane of the bracing (0.5% of the sum of the column loads).
2 Apply the total notional horizontal force to the bracing in the plane
3 Calculate λ_{cr} as BS 59501:2000 clause 2.4.2.6. If λ_{cr} is less than 4.0, the method should not be used.
4 If $\lambda_{cr} < 10$, calculate k_{amp} as BS 59501:2000 clause 2.4.2.7 and amplify the horizontal forces applied to the bracing.

The calculation may be done independently for each load combination for greatest economy.

5.2 Vertical bracing and plan bracing

Where valley columns depend on plan bracing for stability, the flexibility of the complete system of vertical bracing plus plan bracing must be included in the calculation. Figure 10 shows a perspective view of the bracing system in the sway mode. Figure 11 shows a plan view and Figure 12 shows an elevation. In these figures, ΣNHF denotes the sum of the Notional Horizontal Forces from the columns in that plane that are stabilised by the bracing system shown. The figures also show the deflections arising from the Notional Horizontal Forces

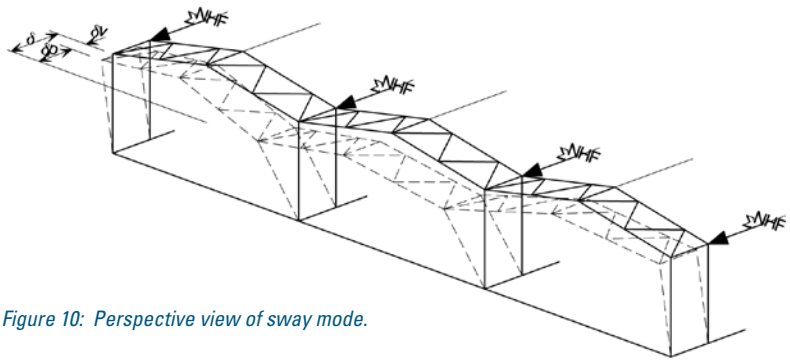

Figure 10: Perspective view of sway mode.

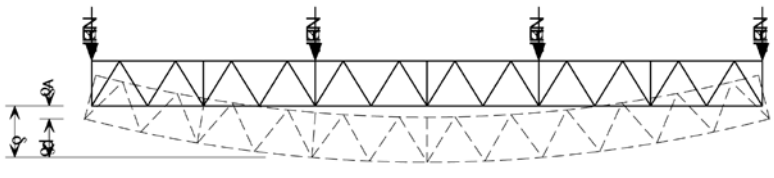

Figure 11: Plan view of sway mode showing plan bracing.

δ_V is the deflection at the top of the vertical bracing
δ_P is the maximum plan bracing deflection at the top of any column
δ (= $\delta_V + \delta_P$) is the maximum total deflection at the top of any column. If a 3D model is used, δ is found directly.

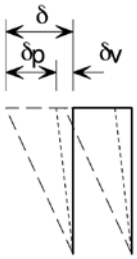

Figure 12: Elevation of sway mode at valley columns.

The procedure is as follows:

1 Calculate the total notional horizontal forces in each plane of columns from the total vertical loads in each plane of columns (0.5% of the sum of the column loads).
2 Apply the total notional horizontal force in each plane to the bracing system at each plane.
3 Calculate λ_{cr} as BS 59501:2000 clause 2.4.2.6 using δ (= $\delta_V + \delta_P$). If λ_{cr} is less than 4.0, the method should not be used.
4 If $\lambda_{cr} < 10$, calculate kamp as BS 59501:2000 clause 2.4.2.7 and amplify the horizontal forces applied to the bracing.

The calculation may be done independently for each load combination for greatest economy.

5.3 Portals in each plane of the valley columns

Figure 13 shows a section through the shed showing the elevation of the valley frame and a potential sway failure in the plane of the valley columns

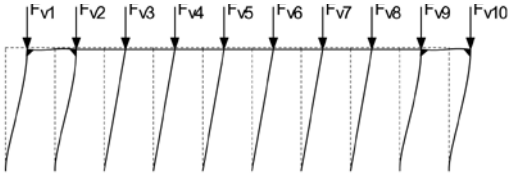

Figure 13: Valley frame sway mode showing column loads F_v.

Valley portals are single storey frames with moment resisting joints, for which BS 59501 clause 2.4.2.6 requires that reference is made to clause 5.5. This gives methods of calculating the resistance of frames. In addition to second-order analysis in clause 5.5.4.5, there are two simplified methods in which second-order effects are allowed for by the additional load factor λ_r being greater than 1.0 for frames in which these effects are significant. These are:

1 the Sway-check method
2 the Amplified moments method

5.3.1 The Sway-check method

The Sway-check method is in clause 5.5.4.2. When applying this method, only the $h_i/1000$ approach should be used and the L_b/D formula approach should not be used because it cannot allow for the loads on all the valley columns. The notional horizontal forces applied should be calculated from the total load on all the valley columns stabilised by the portal. This ensures that the destabilising effects of all the column loads have been included in the calculation.

The procedure is as follows:

1 Check that the geometry of the portal is within the limits of clause 5.5.4.2.1. This is true for most common valley portals.
2 Calculate the total notional horizontal force from the total vertical load in the plane of the portal (0.5% of the sum of the column loads).
3 Apply the total notional horizontal force to the portal
4 Calculate the deflections δ_i and check that $\delta_i \le h_i/1000$. If this condition is not fulfilled the method should not be used.
5 Check the frame for the gravity load case (= gravity loads plus Notional Horizontal Forces)
6 Calculate λ_{sc} and λ_r as 5.5.4.2.3 and check the portal for the horizontal load case (= gravity loads + horizontal loads, eg wind)

5.3.2 The Amplified Moments method

The Amplified Moments method is in clause 5.5.4.4. In applying this method, the calculation of λ_{cr} must be made using a model that includes the vertical loads on all the valley columns stabilised by the portal. This method requires that the value of λ_{cr} includes the effect of any axial load in the valley beam. This will be very small if there is a valley column in each portal frame, but it might be significant in "hit & miss" frames or "hit-miss-miss" frames. This is because the vertical loads applied by the "miss" frames produce a horizontal shear at the bases and thus an axial force in the valley beam. If software is not available to calculate λ_{cr}, then it may be calculated using the formula:

$$\lambda_{cr} \ge 0.8 \left(1 - \frac{F_{R,ULS}}{F_{R,cr}}\right) \frac{h}{200\delta}$$

where $\frac{h}{200\delta}$ is as defined in BS 59501:2000 clause 2.4.2.6

$F_{R,ULS}$ is the axial compression at ULS in the valley beam in the relevant load case

$F_{R,cr}$ is the valley beam Euler buckling load in the plane of the portal in which L is taken as the span of the valley portal and I is I_x if the web of the beam is vertical.

The procedure is as follows:

1 Calculate the total notional horizontal force from the total vertical load in the plane of the portal (0.5% of the sum of the column loads).
2 Apply the total notional horizontal force to the portal in the plane
3 Calculate $\lambda_{cr} \ge 0.8 \left(1 - \frac{F_{R,ULS}}{F_{R,cr}}\right) \frac{h}{200\delta}$.
If $\lambda_{cr} < 4.6$, the method should not be used.
4 Calculate λ_r as BS 59501:2000 clause 5.5.4.4.
5 If using elastic design of the portal, follow clause 5.5.2 which requires that the output forces from the analysis are multiplied by λ_r. (Note that the same result is achieved by multiplying all the applied forces by λ_r, which might be more convenient as a design procedure.) The calculation may be done independently for each load combination for greatest economy.

6 Effective length of valley columns

Valley columns potentially fall into two categories:

1 Columns stabilised by an independent structural system
2 Columns forming the stabilising system

6.1 Columns stabilised by an independent structural system

Columns that are stabilised by an independent bracing system may be designed as "non-sway", as clause 5.1.4. This means that non-sway effective lengths may be used for these columns even if λ_{cr} for the stabilising structure is less than 10. It is recommended that an effective length of 1.0 is taken

6.2 Columns forming the stabilising system

Where the stabilising system is a truss system as shown in Figures 10, 11, 12 and 13, the effective lengths are those appropriate to normal truss design.

Where the stabilising system is a portal system which is checked using the methods in BS 5950-1:2000 clause 5.5, there is no requirement to consider the in-plane stability of the individual members forming the portal because these methods allow for the in-plane buckling effects through the factor λ_r. Only out-of-plane member stability need be checked.

7 Compound columns in valley portals

The compound section created by welding the valley portal leg to the valley column of the main portal has high gross inertia in the plane of the valley frame, but it is susceptible to torsional-flexural buckling which is not covered by BS 5950-1:2000. To avoid the complications of design for torsional-flexural buckling, it is simplest to observe the common practice of considering the main portal and the valley portal as independent frames for the strength calculations. If the designer chooses to calculate the strength of the compound section, guidance on torsional and torsional-flexural buckling is available in references 1 and 2 below. It is important to remember that the load from the main portal is not concentric with the centroid of the compound section.

References

1 Design of cruciform sections using BS 59501:2000, New Steel Construction, Vol 14, No 4, April 2006
2 Design of mono-symmetric and asymmetric sections in compression using BS 59501:2000 New Steel Construction, Vol 14, No 6, June 2006

RED BOOK

Handbook of Structural Steelwork

4th Edition

This handbook gives practical design advice, worked examples, section properties and member capacities. This edition includes the additional 21 new Advance sections produced by Corus and the section property and member capacity tables have been dual titled to reflect the relationship between BS 4 sections and the Advance range of sections. The tables for hot formed tubes have also been dual titled. The handbook is in accordance with the recommendations given in BS 5950-1: 2000.

Full Price: £40
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Steelwork Design Guide to BS 5950-1: 2000

Volume 1 - Section Properties - Member Capacities

7th Edition

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Two for the space of one

Garage space is at a premium everywhere and any scheme which helps mitigate the position is very welcome. A current development in the field is a system that doubles the capacity of a single car garage by accommodating two cars, one above the other.

The system consists basically of a platform pivoting around a central point on the floor and raised and lowered noiselessly by electro-hydraulic mechanism controlled by a single lever. Should the electricty supply fail the platform can be actuated by an emergency crank handle.

With the platform in its lowered position the first car is run onto it and then, by operation of the control lever, raised to the upper position, stopping automatically when this is reached. In the far end of the platform there is a curved recess to accommodate one pair of wheels, thus preventing movement of the car during raising and lowering. On the nearside of the platform is a catwalk and a handrail.

The system is contained in a simple steel frame constructed from standard sections bolted together; the arms for raising and lowering the platforms, also the platform support beams, are of welded fabrication.

New and Revised Codes & Standards

(from BSI UpdatesApril 2007)

SPECIAL ANNOUNCEMENTS

BS 5400:-
Steel, concrete and composite bridges

BS 5400-10:1980
Code of practice for fatigue

This is to inform customers who have purchased this standard via BS Online before November 2006 that they may find they have the unamended 1980 version. Please check that you have the version containing Amendment No. 1 (AMD 9352) from March 1999.

The implications of having the wrong version are that if the instructions in the amended text of Part 10 are not implemented by the designer, which needs minimum fatigue class requirements to be marked on the drawings when the requirement exceeds F2, then the default is that the 'unspecified' class will be deemed to apply when Part 6 is used for inspection of welding on the work itself. If a higher class (F, E and D for example) is actually needed, (which will be the exception rather than the rule in many bridges), then the amount of inspection and the acceptance criteria will not be adequate. The degree of reliability in achieving the design life could be compromised as a result.

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BRITISH STANDARDS REVIEWED AND CONFIRMED

BS 6779:-
Highway parapets for bridges and other structures

BS 6779-1:1998
Specification for vehicle containment parapets of metal construction

BRITISH STANDARDS WITHDRAWN

BS EN 12072:2000
Welding consumables. Wire electrodes, wires and rods for arc welding of stainless and heat-resisting steels. Classification
Superseded by BS EN ISO 14343:2007

BRITISH STANDARDS UNDER REVIEW

BS EN 10067:1997
Hot rolled bulb flats. Dimensions and tolerances on shape, dimensions and mass

CEN EUROPEAN STANDARDS

EN 1337:-
Structural bearings

EN 1337-4:-
Roller bearings
CORRIGENDUM 1: July 2002

EN 1993:-
Eurocode 3. Design of steel structures

EN 1993-1:-
General rules

EN 1993-1-6:2007
Strength and stability of shell structures

EN 1993-1-12:2007
Additional rules for the extension of EN 1993 up to steel grades S700

EN 1993-4:-
Silos, tanks and pipelines

EN 1993-4-1:2007
Silos

EN 1993-4-2:2007
Tanks

EN 1993-4-3:2007
Pipelines

EN 1993-5:2007
Piling

EN 10163:-
Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections.

EN 10163-1:-
General requirements
CORRIGENDUM 1: February 2007

EN 10210-2:2006
Tolerances, dimensions and sectional properties
CORRIGENDUM 1: February 2007

AD 311
T-sections in bending – stem in compression

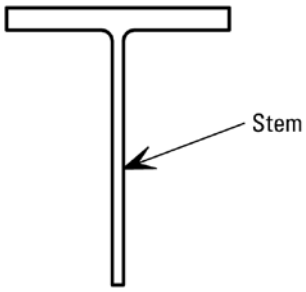

Figure 1: Cross-section of T

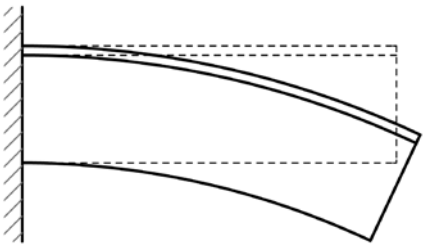

Figure 2: Deflected form of T with stem in compression

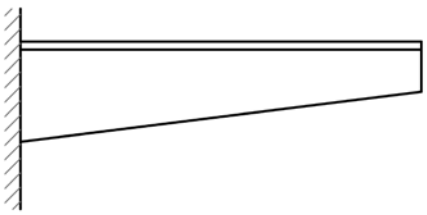

Figure 3: Web reducing in depth along the member

The Advisory desk is often asked advice on the design of T sections in bending. A typical cross-section is shown in Figure 1. Questions arise most frequently when the stem is in compression, as shown in Figure 2, and is so slender that the section is Class 4 because it exceeds the Class 3 limit of D/t = 18ε from BS 59501:2000 Table 11. This AD gives two methods that could be used for the design of Ts in this condition.

One method allows the engineer to use the gross section properties. This method is given in BS 59501:2000 clause 3.6.5 *Alternative method*. This clause leads the engineer to calculate a reduced design strength p_{yr} for which the stem is treated as Class 3, and then uses this reduced design strength for all the subsequent calculations. For very slender stems, calculating p_b is complicated. The steps are as follows:

1. Calculate β = D/t of the section.
2. Calculate the Class 3 limit β_3 =D/t = 18ε.
3. Check $\beta > \beta_3$ (if not, the section is not Class 4 making this method invalid).
4. Calculate $p_{yr} = (\beta_3/\beta)^2 p_y$.
5. Check the lateral torsional buckling resistance of the gross section as a Class 3 section using clause 4.3, but using the bending strength p_b derived from the reduced design strength p_{yr} in place of p_y together with the gross section properties. The slenderness for lateral torsional buckling of T sections is calculated as BS 59501:2000 Annex B clause B.2.8. If the reduced design strength p_{yr} is not less than 235N/mm^2, the bending strength p_b is found from Tables 16 or 17. If the reduced design strength p_{yr} is lower than 235N/mm^2, p_b needs to be calculated from Annex B clause B.2.1. (Alternatively, when p_{yr} is less than 235N/mm^2, p_b may be calculated approximately as = $(p_{yr}/235)\times p_{b235}$, where p_{b235} is p_b for a design strength of 235N/mm^2. This approximation is conservative.)
6. If the lateral torsional buckling check is not clearly more onerous, the cross-sectional resistance to bending should also be checked using p_{yr} and the gross section properties.

An alternative method allows the engineer to use the nominal yield strength of the steel but requires the calculation of effective section properties. The method is given in BS 59501:2000 clause 3.6.3 *Singly symmetric and unsymmetric cross-sections*. (Note that, in cases where there is an axial load on the member, this clause requires that the moment due to a shift of neutral axis is included.) Clause 3.6.3 refers to 3.6.2.2 which says that the effective width of a class 4 slender outstand element should be taken as equal to the maximum width for Class 3 derived from Table 11. The steps are as follows:

1. Calculate the limiting depth for Class 3 = 18tε
2. If D ≤ 18tε, then the stem is Class 3 and the checks are made using the gross section properties.
3. If D > 18tε, then the stem is Class 4 and the section properties are calculated for an effective section in which the depth of the section is limited to 18tε.
4. Check the lateral torsional buckling resistance of the effective section as a Class 3 section using clause 4.3. The slenderness for lateral torsional buckling is calculated as BS 59501:2000 Annex B clause B.2.8. The bending strength p_b is found from Tables 16 or 17 for the design strength p_y.
5. If the lateral torsional buckling check is not clearly more onerous, the cross-sectional resistance to bending should also be checked using p_y and the effective section properties.

The relative advantages and disadvantages of the two procedures shown above will depend on the proportions of the T section.

Sometimes the T has a constant flange section and constant stem thickness, but the stem reduces in depth along the member as shown in Figure 3. To check these cases, it is simplest to calculate the bending strength p_b appropriate to the cross-section where the stem is deepest and use this to check $M_x \le M_b$ at several sections along the member. When using clause 3.6.5 as above, the gross section properties should be used to calculate M_b. When using clause 3.6.3, the effective section properties should be used to calculate M_b.

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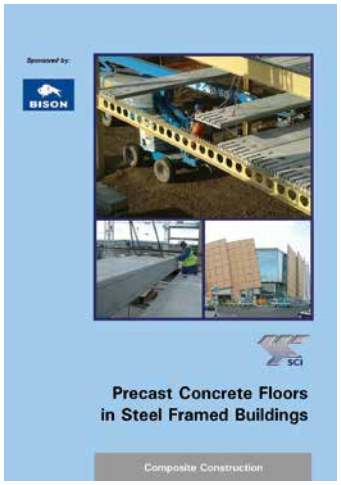

Precast concrete floors in steel framed buildings

Catalogue Reference: P351
Authors: A G J Way, T C Cosgrove and M E Brettle

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This publication provides best practice information on detailing, construction methods and how to satisfy building regulations for the use of precast floor units in hot rolled steel framed buildings. It covers generic information on:

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ISBN 978-1-85942-173 4,
128 pp, A4, colour illustrations, paperback,
May 2006

The British Constructional Steelwork Association Ltd

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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, BCSA, 4 Whitehall Court, London SW1A 2ES
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Building Design Partnership
Bunyan Meyer & Partners Ltd
Buro Happold
Burroughs Stewart Associates
Butterley Ltd
BWB Consulting Ltd

C.S.C. Engineers Ltd
CADS (Computer & Design Services Ltd)
Cairnhill Structures Ltd
Caledonian Building Systems
Cameron Taylor
CampbellReith
Capita Gwent Consultancy Ltd
Capita Symonds
Cardiff County Council
Cardiff University
Carnaby Steel Structures
Carter Design Group
Cass Hayward LLP
Caunton Engineering Ltd
CB&I UK Ltd
CEL International Ltd
Cheshire County Council
Chieftain Contracts Ltd
CIRIA
City University
Civil & Structural Computer Services Ltd
Clarke Bond Group Limited
Clarke Nicholls & Marcel
Clarkslegal LLP
Clegg Associates
Cleveland Bridge UK Limited
CMF Limited*
Collis Engineering Ltd
Compass Engineering Ltd
Complete Design Partnership Ltd
Composite Design Ireland LLP*
Conder Structures Ltd
Conwy County Borough Council
Cordell Group Ltd
Cornwall County Council
Corus Group plc
Coventry Construction Ltd
Coventry University
Crown Structural Engineering Ltd
CSC (UK) Ltd
Cundall
Curtins Consulting Engineers
CWT Partnership

D A Green & Sons Ltd
D H Structures Ltd
D J Hartigan & Associates Ltd
Dalton Consultants
Deakin Walton Limited
Defence Estates
Denningfield Limited
Devon County Council
Devonport Management Ltd
Dewhurst Macfarlane and Partners
DGT Steel & Cladding Ltd
Discain Project Services Ltd
Dorman Long Technology Ltd
Dougall Baillie Associates
Doyle Partnership
Dundee City Council

Eastwood & Partners
Edmund Nuttall Ltd
Elland Steel Structures Ltd
Elliott Wood Partnership LLP
Emmett Fabrications Ltd
Engineered Offsite Limited
Engineering Solutions Partnership
Evadx Ltd
Evans & Langford LLP
Expedition Engineering Limited

F J Booth & Partners Ltd
F J Samuely & Partners Ltd
Faber Maunsell
Fabsec Limited
Fairfield-Mabey Ltd
Fisher Engineering Ltd
Flint & Neill Partnership
Fluid Structural Engineers
Fluor Ltd
Foggo Associates Ltd
Fothergill
Frank H Dale Ltd

Galvanizers Association
Gardenwood Ltd
Gary Gabriel Associates
George Mathieson Associates
Gibbs Engineering Ltd
Gifford & Partners Ltd
Glasgow Caledonian University
Glentworth Fabrications Ltd
GME Structures Ltd
Godsell Arnold Partnership Ltd*
Goodwin Steel Castings Ltd
Gorge Fabrications Ltd
Graham Wood Structural Ltd
Grays Engineering (Contracts) Ltd
Green & Tempest
Gregg & Patterson (Engineers) Ltd
Grontmij
H Young Structures Ltd
Had-Fab Ltd
Halcrow Group Ltd
Halcrow Yolles
Hallmason Design Ltd
Hambleton Steel Ltd
Hanson Building Products Ltd
Harley Haddow
Harold Newsome Ltd
Harry Marsh (Engineers) Ltd
Harry Peers Steelwork Ltd
Haskoning UK Limited
HBG Design Ltd
Henrob Limited
Henry Smith (CE) Ltd
Hescott Engineering Company Ltd
Highcliffe Court Design Ltd
High-Point Rendel
Hillcrest Structural Ltd
Hills of Shoeburyness Ltd
HOP Consulting Ltd
Horwich Steelworks Ltd
HOSDB
HSP Consulting
Hurst Peirce & Malcolm LLP
Hyder Consulting (UK) Ltd

Imperial College London
Integer Software Limited
Inverclyde Council

J Robertson & Co Ltd
Jacobs Babtie
James Bros (Hamworthy) Ltd
James Killelea & Co Ltd
James Lupton Consultants
Jenkins & Potter
John Reid & Sons (Strucsteel) Ltd
John Wicks & Son Ltd
Jordan Pritchard Gorman
Joy Steel Structures (London) Ltd

Kellogg Brown & Root Ltd
Kenneth Brown & Partners
Kier Engineering Services
Kingspan Metl-Con Limited
Kingston University
Knapp Hicks & Partners Ltd

The Laser Cutting Company Ltd
Leach Structural Steelwork Ltd
Leighs Paints
Leonard Cooper Ltd
Les Gooding Design Associates
Lindab Building Systems
Lindapter International
Liverpool John Moores University
London Borough of Hillingdon
Lowe Engineering (Midland) Ltd

M & S Engineering Ltd
M D Fabrications Ltd
M Hasson & Sons Ltd
Mace Ltd
Maldon Marine Ltd
Manchester City Council

Martin Healer Development Services Ltd
Martin Stockley Associates
Maslen Brennan Henshaw
Mason Navarro Partnership
Mech Tool Engineering Ltd
Melliss LLP
Metals Industry Skills & Performance
Metek Building Systems
Metsec Plc
Michael Barclay Partnership
Midland Steel Structures Ltd
Midland Structural Services
Mifflin Construction Ltd
Mike Curnow
Mitchell McFarlane & Partners
MJM Consulting Engineers Ltd
MLM Maddocks Lusher & Matthews
Molabolt
Morgan Est
Mott MacDonald
MSW (UK) Ltd

Napier University
Newbridge Engineering Ltd
Newton Fabrications Ltd
Nolan Associates
Norder Design Associates Limited
Nottingham Trent University
NPS North East Limited
NRM Bobrowski
Nusteel Structures Ltd
NW Structural Consultants Ltd

On Site Services (Gravesend) Ltd
Overdale Construction Services Ltd
Owen Williams Consultants
Oxford Brookes University

Pace Structures Ltd
Parsons Brinckerhoff Ltd
Paul Reading & Partners
Pell Frischmann Consultants Ltd
Pencro Structural Engineering Ltd
PEP Civil & Structures Ltd
Peter Brett Associates
Peter Taylor & Partners Ltd
Pick Everard
Pinnacle Consulting Engineers Ltd
Plandescil Ltd
PMS Fabrications Ltd
Portakabin Ltd
Portal Ltd
Powerwall Systems Limited
Price & Myers Consulting Engineers Llp
Pyper McLarnon Partnership

QMEC Ltd
Queen's University Belfast

R G Parkins & Partners Ltd
RAM International (Europe) Ltd
Ramage Young Limited
Remnant Engineering Ltd
Renfrewshire Council
Richard Lees Steel Decking Ltd
Richard Wood Engineering Ltd
Rigby & Partners
Rippin Ltd
RLT Engineering Consultants Ltd
RMJM Scotland Ltd
Robert Bird & Partners
Robert Tucker Associates
Roberts Engineering
Robinson Construction
Roger Bullivant Ltd
Rowecord Engineering Ltd
Rowen Structures Ltd
Royal School of Military Engineering
RPS Burks Green
RPS Consulting Engineers
RSL (South West) Ltd

S H Structures Ltd
Scott White & Hookins
Scott Wilson Ltd
Selwyn Construction Engineering Ltd
Severfield-Reeve Structures Ltd
Sheffield City Council
Shell UK Exploration & Production
Sherwood & Casson Ltd
Shipley Fabrications Ltd
SIAC Tetbury Steel Ltd
Sir Robert McAlpine Design Group
Skanska Technology
Skidmore Owings & Merrill Inc.
SKM anthony hunts
Snashall Steel Fabrications
South Durham Structures Ltd
South Lincs Consulting Ltd
The Steel People Ltd
Stewart & Harris
Stirling Maynard & Partners
Structural Design Associates
Structural Design Partnership
Structural Metal Decks Ltd
Structural Sections Ltd
Surrey County Council
Survey Design Associates Ltd

T A Kirkpatrick & Co Ltd
Taylor & Russell Ltd
Teague & Sally Limited
Techniker Ltd
Tekla (UK) Ltd
Tension Control Bolts Ltd
Terence McCormack Ltd
Terrapin Ltd
Terrell International
Thomas Morgan & Associates
Thomasons LLP
Tony Gee & Partners LLP
TPS Consult Ltd
Traditional Structures Ltd

University of Aberdeen
University of Birmingham
University of Bolton
University of Bristol
University of Dundee
University of East London
University of Edinburgh
University of Greenwich
University of Leeds
University of Liverpool
The University of Manchester
University of Nottingham
University of Paisley
University of Plymouth
University of Portsmouth
University of Salford
University of Sheffield
University of Southampton
University of Surrey
University of the West of England
University of Wales Swansea
University of Warwick
URS Corporation Ltd

Vertex Systems

W A Fairhurst & Partners
W F Brown Associates Ltd
W S Britland & Co Ltd
Wakefield MDC Building Control
Walsh Associates
Walter Watson Ltd
Warley Construction Co Ltd
Waterman Structures Ltd
Watson Steel Structures Ltd
WCJ Engineers
Wessex Structural Services Ltd
Westbury Park Engineering Ltd
Westok Ltd
Whitbybird
White Young Green Consulting Ltd
WIG Engineering Ltd
William Haley Engineering Ltd
William Hare Ltd
William J Marshall & Partners
The Willocks Practice
Wood Boyle Partnership
Wright Associates
WSP Group

ORGANISATIONS WITH MEMBER SERVICE AGREEMENTS WITH THE SCI

Department of Trade & Industry (DTI)
Health & Safety Executive (HSE)
Highways Agency
Institution of Structural Engineers

INTERNATIONAL CORPORATE MEMBERS

Australia
Australian Steel Institute
BlueScope Steel Research
Cocciardi Pty Ltd

Belgium
Bocad Service International S A
International Iron & Steel Institute (IISI)
Staalinfocentrum - Centre Information Acier

Brazil
Brazilian Centre of Steel Construction (CBCA)
CODEME Engenharia S.A.
Gerdau Acominas S.A.
Universidade Federal de Ouro Preto
Universidade de Sao Paulo
USIMINAS

Canada
Canadian Institute of Steel Construction

Chile
Construcciones Y Montajes S.A (COYMSA)

Croatia
Institut Gradevinarstva Hrvatske d.d.

Egypt
Project Management Systems

Finland
HAMK University of Applied Sciences
Rautaruukki Oyj
Seinajoki Polytechnic
VTT Building and Transport

France
CTICM
Terrell International

Germany
Bauen mit Stahl e.V.
Stahl + Verbundbau gmbh

Greece
Computer Control Systems SA
Democritus University of Thrace
K.Liaromatis SA
Maraveas & Associates SA
Metallostegastiki SA
Technical Chamber of Greece (TEE)

Hong Kong
Arup Group
Corus Asia Ltd
The Hong Kong Polytechnic University
WSP Asia

India
Bechtel Overseas Corporation
Institute for Steel Development & Growth

Ireland
Andrew Mannion Structural Engineers Ltd
Barrett Mahony Consulting Engineers Ltd
Barry Kelleher & Associates
CBA Consulting Engineers*
C S Pringle Consulting Engineers
Corus Ireland
Coyle Kennedy Ltd
DBFL Consulting Engineers Ltd
Denis O'Sullivan & Associates
Downes Associates
Duggan Steel
ESB International Ltd
Fox Bros Engineering Ltd
Frank Fox & Associates
Fusion Building Solutions
Goggin Buckley Structural Steel
Hanley Pepper Consulting Engineers
Hayes Higgins Partnership
J B Barry & Partners Limited
Jacobs Engineering
Joda Engineering Consultants
John Killian & Co Structural Engineers*
Kilgallen & Partners Consulting Engineers Ltd
Leonard Engineering (Ballybay) Ltd
McCabe Delaney
The McKenna Pearce Practice
Michael Punch & Partners
Milltown Engineering Ltd
National University of Ireland, Galway
Nestor Kelly
Newell Roofing Products
Norris Bros Ltd
O'Connor Sutton Cronin
Oliver Russell & Associates Ltd
Paddy Wall & Sons
Pat O'Gorman & Associates
Project Management Ltd
RPS Consulting Engineers Ltd
SIAC Butlers Steel Ltd
Stanta Limited
Steel & Roofing Systems Ltd
T J O'Connor & Associates
TOBIN Consulting Engineers
Walsh Draughting Services Ltd

Italy
Politecnico Di Milano
Universita Degli Studi Di Trento

Kenya
David Engineering Ltd
Steel Structures Ltd

Korea
Hyundai Steel Company
Korea University

Principality of Liechtenstein
HILTI AG

Lithuania
Vilnius Gediminas Technical University

Malaysia
Corus Asia Ltd
Universiti Teknologi Malaysia

Malta
TBA Periti

The Netherlands
Bouwen met Staal
Delft University of Technology

New Zealand
Heavy Engineering Research Association

Norway
Tee Consult Holding AS

Pakistan
Metecno Pakistan (Pvt) Ltd

Portugal
Universidade de Aveiro
Universidade de Coimbra – Polo II

Qatar
Metalex Trading & Contracting Co. W.L.L

Romania
Altiscad SRL

Republic of Singapore
Corus South East Asia Pte Ltd
Jurong Engineering Ltd
LSW Consulting Engineers
Ngee Ann Polytechnic
Singapore Structural Steel Society

South Africa
Southern African Institute of Steel Construction
Tricom Structures

Spain
In Hoc Signo Vinces, S.L.
ITEA
University of Navarra

Sweden
Luleå University of Technology
Swedish Institute of Steel Construction

Turkey
CIMTAS Celik Imalat Montaj Ve Tesisat A.S.
UMO Architecture Engineering and Consulting Ltd Co

United Arab Emirates
Corus Middle East
GINCO Steel L.L.C.
Techno Steel Construction Co
WSP Middle East Ltd

USA
American Institute of Steel Construction Inc
American Iron & Steel Institute (AISI)
Corus America Inc
Epic Metals Corporation
Steel Recycling Institute

**New corporate members since last long list in March 2007 issue*