JUNE 2006 VOL 14 NO 6

NSC

NEW STEEL CONSTRUCTION

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Steel framed classic for City
Glasgow shopping mecca
BCSA scores a century

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Cover Image
14 CORNHILL, LONDON
Client: IVG Asticus Real Estate
Architect: DLG Architects
Structural Engineer: whitbybird
Steelwork Contractor: Graham Wood Structural

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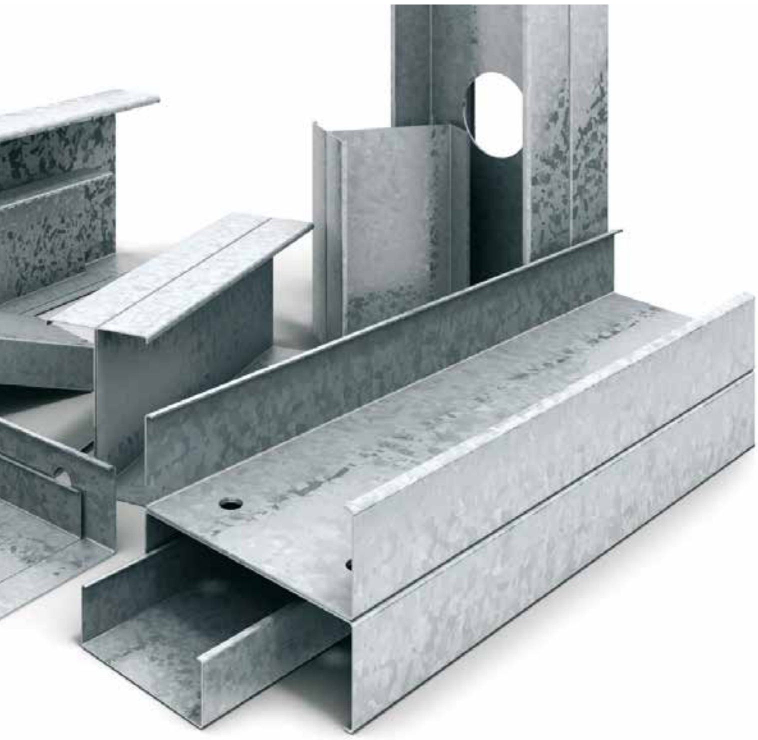

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No need for Eurocode haste

Nick Barrett - Editor

There is a lot of myth and misinformation doing the rounds about the introduction of Eurocodes, but one thing that should be clear is that there is no need to rush into anything. Professor David Nethercot makes that point in his report in this issue on where we have got to with Eurocodes, and what organisations should be thinking about doing.

There is never any room for complacency when crucial changes like this are in the offing, but the balance of risk seems to be against doing much more than simply keeping a watching brief until timetables for the introduction of Eurocodes are clearer. Leading design practices have said that they are not even going to think about Eurocodes for some time – some have even banned staff from going on Eurocode related training for the time being.

Discussions between the Department for Communities and Local Government and the steel sector have confirmed that there are no plans to remove BS 5950 Part 1 from the Building Regulations for many years ahead. Government will only take that step if industry makes the switch itself. Even if BSI decided to drop BS 5950 Part 1 the construction industry could maintain it as an 'industry standard'.

It is worth remembering that it took over 20 years to make the switch to BS 5950 Part 1 from BS 449. BSI seems to think that the switch to Eurocodes will take place over three years, but this is an impractical timetable. The European Commission agreed with the European Standards Organisation (CEN) that the switch would take at least six years or so. BSI might like everyone to purchase new standards within a three year timescale, but whereas that might suit BSI's commercial needs, it would not suit the industry's.

However, the steel industry recognises that we are approaching a transition period and is working hard to ensure that appropriate information and guidance will be available as and when required.

The steel sector is in talks with government, the procurement specialists in the Office of Government Commerce and leading clients to determine a clear definition of policy and a timetable. Everyone will be kept fully posted and fears about being left behind in the rush to 'Europeanise' steel design can be put to one side. Design to BS 5950 Part 1 can continue to be used for many years yet.

Competitive advantage growing

Prices of all the raw materials needed to make steel have been rising strongly on world markets as the commodities boom continues. Nobody can tell how much further this boom has to run, or how far raw materials prices might fall back when and if it does end.

One thing that can be reasonably confidently predicted though is that steel will retain its competitive advantage in the marketplace against competing materials. BCSA has predicted rises of an average of 15% for fabricated steelwork over the course of 2006. Producers of alternative materials are feeling the same upward pressures as steel manufacturers and it is worth remembering that a concrete framed building, for example, relies on steel to a remarkable degree, containing only 33% less steel than a steel framed building.

The market is choosing steel for a combination of reasons other than price anyway. The sustainability arguments for instance are compelling, with 94% of steel already recycled. This figure was achieved routinely before the world was anything like as sustainability conscious as it is today, and the industry is committed to making that figure rise. Safety is another area where the steel sector is gaining recognition and clients increasingly ask, what price a safer site? Rather than focus on the price of steel, clients should be encouraged to look at the costs of not using it.

Order book levels remain strong

Prices for fabricated steelwork are expected to rise by only an average of 15% over 2006, depending on the type of building, according to forecasts from the BCSA.

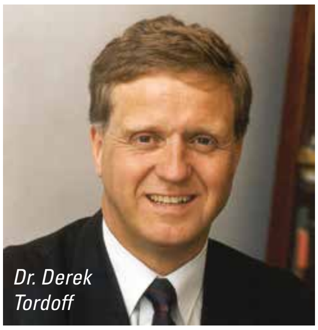
Strong demand, continuing upwards pressure on raw materials and other production costs are driving worldwide steel prices higher, leading producer Corus to increase the price of steel sections at the end of April 2006. Mill prices are expected to rise again in the summer, with the possibility of a further increase in the autumn.

"Despite the increases steel continues to be the world's most popular construction medium and UK steelwork contractors are experiencing record levels of demand with order books now at typically six months," said BCSA Director General Dr Derek Tordoff.

BCSA said Stockholder prices may increase more than mill prices. Prices for plates and tubes may increase at higher rates than sections, due to very large demands from the energy sector. Prices for galvanizing are expected to rise significantly again, which will feed through prices for purlins and decking.

"All construction materials are feeling the same upwards pressure on prices," says Dr Tordoff. "It is worth noting that steel framed buildings contain only 33% more steel than an equivalent reinforced concrete building. Concrete buildings are affected not only by material price increases in steel, but also the rising costs of cement, aggregates, shuttering and site labour."

Safety, reliability and sustainability are increasingly accepted as key issues in steel's favour. Quality and reliability will be further advanced in September 2006 when CE marking of


Dr. Derek Tordoff

steel sections becomes the norm. Market research shows that steel is continuing to win new markets in schools, hospitals, residential buildings and car parks. Safety and reliability are becoming more widely recognised as key advantages of building with steel.

Air lift for sky bridge

Three large 18m-long steel sections, which form Heathrow's T5 skybridge, have recently been lifted into position with the aid of a 500t capacity crane.

Each weighing in excess of 20t, the plate girders together with their intermediate sections were fabricated on site by Watson Steel Structures.

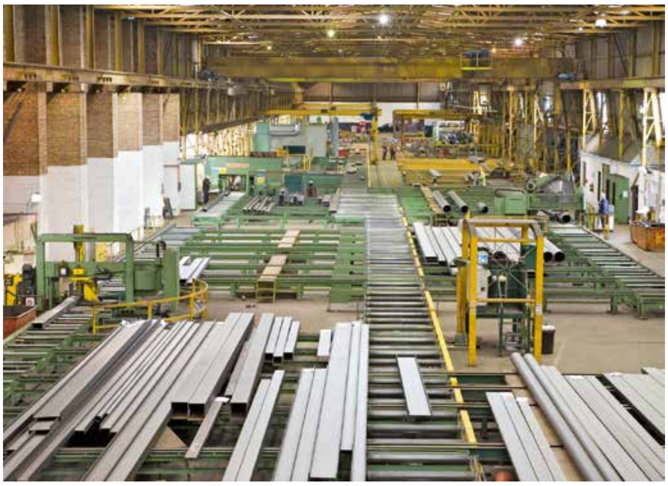
The skybridge links twin lift towers from the railway station and car park to the main T5 departure gates.

Tony Whitten, Watson Steel Structures Contracts Director said the bridge has been dubbed the 'letterbox' because it fits into a hole in the main terminal building. "Each section was erected with an attached temporary workplatform so other activities could be carried out," Mr Whitten said.

Once in position, further steelwork will be installed to support the sides and lid of the bridge. "All of this architectural steelwork is exposed," Mr Whitten added.

The skybridge is part of Watson Steel Structures' on-going T5 steelwork contract.

Conder gets Kaltenbach fit-out



Conder Structures' newly refurbished processing lines in Burton-on-Trent have benefited from a major investment in new Kaltenbach equipment.

The recently installed machines consists of a new state-of-the-art KC1201 robotic head plasma coping system, the latest generation Gietart 1530-625 turbine, SHD shot blasting and handling system, and a new measuring system for an existing Kaltenbach bandsawing machine.

An existing Kaltenbach HDM1430 heavy-duty saw has been fully integrated into the new handling layout, which also manages the requirements of another existing drilling machine.

Kaltenbach said the new plasma enables rapid laser cutting, straight and profiled processing of columns and beams, while cut accuracy is so good that some fabrication is possible straight from the machine.

A key element of the new facility is a Kaltenbach central conveyor which runs for an impressive 250m, enabling each process to feed material on or off the conveyor as required and to reliably withstand the high tonnage loads.

Conder Production Director Phil Lunney said: "The structural fabrication industry is an extremely competitive market, the investment in our new line has undoubtedly further advanced our competitive edge."

BCSA to host key nationwide standards seminars

The British Constructional Steelwork Association (BCSA) is holding a series of four key one-day seminars to provide a solid introduction to the range of imminent European standards.

The four seminars kick-off in London (see diary page 10) on 26 September, with following dates in Huddersfield, Glasgow and Belfast.

Topics will include an introduction to the Eurocodes and their associated National Annexes, an in-depth look at the Loading Eurocodes and Basis of design, together with the transition timetable from British Standards.

Speakers will include Dr Roger Pope, consultant to the BCSA and Chairman of the BSI Steelwork Fabrication Committee, who will give a presentation of the European standard for the execution of steel structures. This standard will eventually replace the national standard BS 5950-2.

Dr Pope will introduce the European standard's new concepts such as execution classes and welding coordination, as well as explaining the main differences with the current standard.

Charles King of the Steel Construction Institute will present a detailed lecture on Eurocode 3 for the manufacture of steel beams and columns.

"These seminars will provide the industry with an insight into the complete package of imminent European standards," Dr David Moore, BCSA's Director of Engineering said.

Dr Moore said the CE marking of steel products will also be covered as well as the implications for engineers for the specification of design, fabrication and construction.

New bridge arch spans the Clyde

Two 500t mobile cranes have lifted the final section of steel arch into place above the River Clyde as work to erect Glasgow's elegant new Finnieston road bridge enters its final phase.

The £14M bow string arch bridge was designed and built by Nuttall and features a single steel 100m-long arch that crosses transversely from one side of the deck to the other. The bridge has a span of 96m, crosses the water at an angle of 31° and is set to improve connectivity between the city centre and the new Pacific Quay enterprise area on the south of the river.

Nine components of the steel arch were fabricated by Watson Steel Structures in Bolton and painted on Merseyside. The units were transported to Glasgow by road and welded together in three curved sections on the completed bridge deck.

The steel composite bridge deck is made up of 110 precast units and was constructed in a dedicated yard 1km downstream from the bridge site. The units were transported to the bridge site along the river and lifted into position using a 300t capacity floating crane.

Steel tubular piles driven into the river bed have supported the bridge during construction and 14 tie bar hangers were strung from the arch to the deck by Watson Steel Structures in May. The Finnieston bridge, the first new road crossing of the Clyde in 35 years, is set to open in August.

Steel opens up listed building

Bourne Steel is helping Great Portland Estates to bring new life and function to a listed 100-year office block through cutting edge design. The tired five-storey building is undergoing an innovative conversion, creating a modern, light and airy open-plan space, whilst preserving the historical façade.

The company is utilising 600t of steelwork during the refurbishment of 190 Great Portland Street in central London, to create a pioneering steel skeleton which will support the contemporary floor plan.

A total of 29 new steel main columns have been installed to provide novel floor support, and once these were established, each floor had its myriad of partitioned old walls demolished.

Brendan White, Bourne Project Manager said a top-down construction method provided the most pertinent and efficient solution.

At roof level two 1.5m deep 10t plate girders have been erected, from which new steel-lined cores are hung.

"We basically in-filled three existing light wells to create these cores," Mr White explained. "These now provide the backbone of the refurbished building and during the erection we utilised pre-fabricated steel ladder frames to aid both construction and the programme."

The building's floors are made of clinker and their fragile nature dictated that just getting the steelwork into the building was a major challenge.

All steelwork was initially craned up to the roof level and then meticulously lowered into the building. "We couldn't store too much on the floors at any one time, so we made a temporary bridge which transported the steel up and down one of the light wells. This then extended into each floor level as and when it was required, to off-load the steelwork" Mr White explained.

AROUND THE PRESS

Structural Engineer
16 May 2006
(from the **Correspondence** section)
Composite steel construction, if properly designed, is perfectly suitable for hospitals and other buildings in which low vibration environments are required.
Peter Young and Michael Wilford of Arup

Contract Journal
17 May 2006
Why steel is a safe bet
The constructional steelwork industry holds an enviable safety record compared with the experience of other construction sectors....A major reason why steelwork erection is safer is the increasing practice of carrying out on-site work – mostly bolting together of steel sections – from the relative safety of cherry pickers, or mobile elevating work platforms (MEWPs).

New Civil Engineer
18 May 2006
Doomed Bournemouth car park lacked vital elastomeric bearings
Missing elastomeric bearings have been blamed for connection failures in a 3,000 space two storey concrete shopping centre car park in Bournemouth last year. A confidential report by Arup for car park owner Castlepoint condemned the design and is believed to have led to last week's decision to completely rebuild the structure.

The Times
22 May 2006
Warship built out of Twin Towers wreckage
Bringing together America's two greatest calamities of the 21st century, the USS New York is being built in New Orleans with 24 tonnes of steel taken from the collapsed World Trade Centre. There is no shortage of scrap metal in New Orleans these days, but the girders taken from Ground Zero have been treated with a reverence usually accorded to religious relics.

Seminars to outline sustainable construction

Corus Construction and Industrial has organised two free seminars for this month which will bring together some of the UK's leading experts on sustainable construction.

The two events will be chaired by John Dowling, Corus Construction Development Manager who said: "The seminars will discuss the obligations and opportunities created for the construction sector by the increasing demand for sustainable buildings."

Mr Dowling added the seminars will also describe the background to sustainable construction and the benefits it can bring to society as a whole.

Matthew Teague, Consultant Architect at Corus Construction will discuss the role of regulations in the drive for sustainability. His presentation will highlight landfill taxation, the code for sustainable buildings, and the impact this will place on the client and their professional representatives.

Recyling, re-use, refurbishment and reduce sums up the presentation of Walter Swann, Regional Technical Manager at Corus Construction. He will reveal how the steel from the de-molished Lackenby steel plant was tracked through the reclamation to the new steelmaking process and the major projects that resulted.

Other speakers include Professor Roger Plank of the University of Sheffield, who will focus on the importance of operational energy use in buildings, in particular how to design to reduce energy use, including the requirements of the new Part L regulation.

Highlighting the sustainable use of steel two case studies will be discussed. At the Leeds seminar, the Devonshire Building at the University of Newcastle-upon-Tyne, which has picked up a number of design and sustainability accolades, is the chosen topic. This low energy building exceeds UK best practice targets by 30%.

At the London event, the highlighted project will be the Oxford University Department Building. This building has achieved a reduction in CO2 emissions due to its use of steelwork.

The two seminars will take place at the Leeds Thorpe Park Hotel on 6 June, and the Cavendish Conference Centre, London on 28 June.

For further information or to register contact: www.corusevents.com

Framework for Chiswick Park

The fifth office block in the prestigious Chiswick Park development in west London has recently been opened by developer Stanhope.

Offering 13,000m^2 of offices and 1,300m^2 of retail space, the four-storey building features a distinctive steel framed external structure which supports a surrounding louvre canopy.

Steve Roberts, Arup's Project Designer said the steel frame is so large that its basically a major structure in its right.

"The lightweight nature of steel meant there was no other material for such as structure," Mr Roberts said. "And architecturally, steel also makes that supporting frame look elegant as well as being cost effective."

Featuring 20 slender 18m-high steel columns, the supporting frame is tied into the main building at roof level. Extending out from the building the external frame is topped with a number of aluminium louvres (sunshades) which will keep out excessive sunlight.

The frame also supports external steel staircases which cascade down the sides of the facades.

Custom Metal Fabrications (CMF) supplied 240t of steelwork for the project. David Gibbs of CMF said: "The steelwork is all architectural and the columns have pin connections at top and bottom. The canopy itself is constructed with primary beams connected by tension rods which support the sunshades."

Above and below: Four other completed blocks also feature a steel frame external structure

New steel decks for multi-span viaduct

More than 2,400t of steelwork is currently being delivered by Fairfield-Mabey to south Cumbria for the refurbishment of the Leven rail viaduct.

Taking place during a 16 week line closure, main contractor Carillion is replacing all of the 49 spans' walkways and decks.

The viaduct was orignally built in 1857 and carries the Carnforth to Barrow-in-Furness railway across the Leven Estuary. The old structure consists of an iron/steel deck supported on brick/reinforced concrete piers, with spans varying in length from 9m to 12m, and a navigational span of 20m.

Matt Wylde, Carillion Project Manager said the importance of steel being delivered promptly is paramount as the Viaduct is scheduled to re-open on 17 July 2006.

"Steelwork for the new walkways was first to be erected and by the end of April we were halfway through installing them," Mr Wylde said. "Then during May our ten-week deck replacement programme got into full swing."

Apart from the widening of the Viaduct to a twin-track structure in 1863, and some pier encasement works carried out in 1915, this is the first time the decks and walkways have been completely replaced.

Dr Peter Lloyd, Fairfield-Mabey Managing Director said most of the 49 spans are around 9m in length, with the exception of the central navigational span, two 7m, a 10m and a single 12m span.

"After a detailed survey we discovered a total of 16 different deck geometries, all requiring unique 3D models, were needed," Dr Lloyd explained.

"Our use of automation and robot welding based directly on 3D modeling means we are able to fabricate and deliver girders within a tight schedule," Dr Lloyd said.

Sheds aid Dunstable regeneration

Atlas Ward Structures is currently working on a regeneration scheme in Dunstable located at the former site of the Bedford Truck manufacturing plant.

Working on behalf of main contractor Fitzpatrick and client ProLogis Developments, the company is supplying and erecting more than 2,500t of steelwork for the construction of two distribution sheds.

The sheds at ProLogis Park Dunstable are being built on a speculative basis, and offer 49,796m² and 22,250m² of floorspace respectively.

"We have already had significant interest in the development, so we are pleased that we can move ahead with construction work, which will be completed by the middle of this year," Paul Weston, First Vice President of ProLogis said.

Peter Church, Atlas Ward Project Manager said the larger shed has nine spans, is 22 bays long and features 69 docking bays for trucks, while the other shed features four spans and 22 bays.

"Both units have 29m-long spans and we typically used 686mm and 533mm beams," Mr Church said.

NEWS IN BRIEF

BCSA warns that as European standards for steel products (such as steel sections and structural bolts) are replacing National standards, from September this year steel sections will have to comply with the Construction Products Regulations, which makes **CE marking** for steel sections a de facto requirement. Within the next two years our National standards for steel fabrication (BS 5950 Part 2) will be replaced by the European standard EN 1090-2, requiring fabricated steelwork to comply with the Construction Products Regulations, which will make CE marking for fabricated steelwork also a de facto requirement.

CSC has launched a new Version 7 of its **Fastrak Building Designer**. Features include a facility for truss design, automatic 3D analysis and load distribution, two-way integration with Westok's Cellbeam software while 3D+ has been substantially updated.

The British Group of the International Association for Bridge and Structural Engineering has invited submissions for the **Milne Medal for Design Excellence**. Candidates must be chartered members of a British Engineering Institution. For further information contact email: d.nethercot@imperial.ac.uk

William Haley Engineering has won the Construction News 2006 Steelwork Specialist of the Year award. The judges said: "A great little company that seems to be about finding solutions, not excuses."

The **2006 Steel Construction Institute year book** is now available in a CD format. For copies email Paul Turp at dpMedia (paul.turp@dpmedia.co.uk) or Tel: 0117 904 1283.

Innovative crossing for Kew Gardens

London's Royal Botanic Gardens at Kew has a new landmark bridge crossing one of its many landscaped lakes.

The 70m-long bridge is called the Sackler Crossing in recognition of the foundation that enabled its construction, the Dr Mortimer and Theresa Sackler Foundation.

London-based architect John Pawson, who is known for his minimalist style designed the structure, while Buro Happold provided the detailed engineering design and specification.

"This is an exceptional project," Simon Fryer, Associate in the Buro Happold bridge engineering group said. "It's been challenging in a lot of ways but I think we've helped create an amazing structure."

The bridge crosses a lake which is hydraulically linked to the River Thames. Prior to construction, it was fully drained and a causeway installed to aid the building programme.

A series of nine driven 457mm diameter steel piles were inserted, and these are extended as columns above the water level. On them rests 30t of structural steelwork that forms a framework onto which a granite deck is bolted.

Driving the piles was one of the biggest challenges according to Mr Fryer. "Due to the clay soil on the lake bed, the piles couldn't be removed once inserted and so it was vital the contractor accurately positioned them," he said.

However, to safeguard against any piling error, Buro Happold built-in tolerances in the structural frame to allow for up to 10cm movement.

The black granite deck is made up of sleepers each weighing 130kg. To accommodate the curves in the bridge's plan, gaps taper across the width of the deck. A total of 990 aluminium bronze uprights are bolted to the structural frame and act as pedestrian handrails.

Three steel sheds for Staffordshire park

Caunton Engineering has supplied and erected 2,300t of steelwork for the first three distribution sheds on a new ProLogis Park in Stafford.

Known as Prime Point 14, the development covers 128 acres and is situated adjacent to Junction 14 of the M6 motorway.

Interestingly, there is much local sensitivity and respect for the site as the new buildings are close to the spot, where, in order to avoid the local townspeople, a US fighter pilot crashed his plane during WWII.

The three sheds, offering 542,000, 127,000 and 70,000 sq ft of floor space respectively, are the first buildings to be erected on site by Fitzpatrick Contractors, the project's main contractor.

Grenville Griffiths, Project Manager for Caunton says the whole steel erection programme was completed in ten weeks.

"We did the largest shed in the first six weeks, and then erected the other two simultaneously during the following four weeks," Mr Griffiths explains.

The largest shed, known as DC1, is a five-span structure erected with 610mm x 299mm columns and 457mm x 152mm rafters.

The other two units - DC2 and DC3 - are both twin-span buildings of 38m and 35m lengths respectively.

Diary

22 June 2006
Structural Steel Design Awards Luncheon
Winners of the 2006 awards sponsored by Corus, the BCSA and the SCI, will be announced.
Savoy Hotel, London. Contact Gillian.Mitchell@steelconstruction.org

September – December 2006
New European Standards for Steel Construction
A series of one day seminars. See p7.
Tuesday 26th September 2006 – National Liberal Club, London
Wednesday 18th October 2006 – Cedar Court Hotel, Huddersfield
Wednesday 15th November 2006 – Hilton Hotel, Glasgow
Wednesday 6th December 2006 – Culloden Hotel, Belfast
Contact Gillian.Mitchell@steelconstruction.org

8 – 9 November 2006
Steel Construction Conference
The conference coincides with the 50th Anniversary of the Southern African Institute of Steel Construction (SAISC) Johannesburg
For details email renee@saisc.co.za

Preparing to work with Eurocodes

Structural steelwork designers can take heart from being better supported than most as they look forward to grappling with the changeover to Eurocodes, says Professor David Nethercot of Imperial College.

Professor David Nethercot

The 2004 Report prepared by the Institution of Structural Engineers that identified the tasks facing the UK in migrating from a Structural Design environment based on National Standards to one based on the forthcoming Eurocodes included the quote: "Eurocodes represent the biggest change ever faced by the Structural Engineering profession in the UK". It went on to emphasise this by stating that the change was more pervasive than Metrication and more extensive than the switch to Limit States. Two years on it is appropriate to reconsider the position, to assess what remains to be done, to note that some progress has been made and, most importantly, to appreciate the likely effects on individuals and companies.

Designers nowadays work with a wide range of supporting material e.g. Manufacturers' literature, handbooks and design guides, computer software, explanatory texts, sets of worked examples etc. Thus it is not just the introduction of the new codes themselves that is so significant; of far greater importance is the need to update and modify much of this supporting infrastructure so that it too relates to the new rules, procedures and practices of the Eurocode documents. Such a task takes time, requires attention from the relatively small group of people currently sufficiently well informed about Eurocodes to be in a position to prepare the items and, of course, needs money to underwrite it. Despite continuous support for Britain's role in assisting in the preparation of the Eurocodes over many years, Government nowadays is much less inclined to provide financial support for the implementation phase, with the result that the great majority will need to come from within the Industry. Fortunately for structural steelwork, there is a long history of cooperation between BCSA, Corus and the SCI – acting in conjunction with individuals from companies and universities – to undertake work of this type. We will need to rely heavily on this community again over the next few years.

Recognise that the transition will take years – not months and not decades – and plan accordingly.

It is not uncommon to see letters in technical magazines suggesting that the UK should simply retain its existing system and not implement the Eurocodes. Much as we might be attracted to such a position, it is simply not possible. When the UK signed up to the Treaty of Rome, it effectively agreed to phase out all work on National Standards for Construction and to adopt a common European system. Whilst it has taken rather longer than was originally anticipated, we are now at the stage when that expectation is becoming the reality. Of course, it will continue to be possible to use British Standards in certain instances for several years into the future. However, the supporting infrastructure will cease to be maintained and all new developments will be firmly based on the Eurocodes. It will therefore become increasingly difficult to operate in the old way and, one suspects, increasingly difficult to gain acceptance for that practice.

What, therefore, should organisations be doing to prepare themselves? More imaginatively, how can at least some be sufficiently astute to see benefits in the transition? The following is suggested:

1. Recognise that a transition will be required. Schedule it into future business plans and treat it in the same way as any other major project is regarded e.g. the installation of a new computer system, moving to new premises etc.
2. Analyse the position carefully, especially the likely changes over the next few years e.g. a small organisation with no history of working outside the UK and with the majority of its work in modest projects of a generally local nature will need to adopt a completely different approach to a large multinational consulting practice with ambitions to significantly expand their operation into many parts of mainland Europe.
3. Don't be panicked into precipitate action through reading comment and opinion in technical magazines – especially when the author might have vested interests e.g. the purveyors of educational courses.
4. Recognise that the transition will take years – not months and not decades - and plan accordingly.
5. Following the well publicised exercise conducted by one small firm of consulting engineers, recognise that the principal costs will be in staff training and lack of familiarity with new processes and seek out the most cost-effective ways of addressing this.

Although there are many – probably the majority – among the structural community who would certainly not have voted for the adoption of the Eurocodes had that choice been available, the reality is that the community must now make the best of the situation and seek out whatever opportunities it can to turn the transition into benefits. Within the structural steelwork community we are fortunate to be much better supported than is the case in most other areas and, moreover, for that support to have been actively involved with the Eurocode process and thus to be in a position to provide objective, relevant and timely assistance. The community will certainly be looking to BSCA/Corus/SCI to give a lead and to provide some of the new material and facilities; it must also recognise that the major responsibility rests with itself and that each of us will need to find our own way of accommodating the changes.

New mecca for Glasgow shoppers

Fast track construction, environmental friendliness and in-built flexibility were the must-have's on the shopping list for the giant Silverburn retail development in Glasgow. Martin Cooper checks out how steel delivered.

FACT FILE
Silverburn shopping centre, Pollok, Glasgow
Main client: *Retail Property Holdings*
Architect: *BDP*
Structural engineer: *Stuart McTaggart*
Design and build contractor: *Bovis Lend Lease*
Steelwork contractor: *Severfield-Reeve Structures*
Project Value: *£350M*
Steel tonnage: *10,300t*

The down at heels Glasgow suburb of Pollok is set to become one of Scotland's leading shopping destinations. At the end of next year, the area's £350M Silverburn retail development, boasting more than 90 shops and 14 restaurants, is scheduled to open its doors.

Offering 1 million sq ft of retail space, Silverburn is said to be the largest shopping complex in Scotland that isn't located in a city centre. Situated adjacent to the M77 Junction 2, a new dedicated slipway is under construction. This, the developer says, will allow the more than 2.5 million people who live within one hours drive of Silverburn easy access to the site.

Alistair Kell, Project Director at BDP envisages the project will also act as a catalyst for the redevelopment of Greater Pollok. "Silverburn will be a primary retail destination within the central belt of Scotland and has been conceived to encompass the local community and instill a greater sense of civic pride to the area, making Pollok great once more," he adds.

As well as being one segment of a much larger scheme - a giant 13,500 sq ft Tesco is nearing completion and various other schemes are in the pipeline - the Silverburn shopping centre has thrown up a number of interesting design challenges.

Gerry Stuart, Director of structural engineers Stuart McTaggart says one of the main reasons for choosing a steel-framed structure was the speed of construction that it allowed. "The developer had already signed a contract with Debenhams, before the majority of the design team came on board, for its store to be ready for fit-out by autumn 2006. This meant we've always had a very tight programme to meet."

As the Debenhams store is one of the two main anchors for the initial Phase 1 of the project, it has been one of Silverburn's principle drivers.

To speed up the entire construction process, Mr Stuart says that all steelwork had to be fast-tracked and six months before the main contractor was even appointed all steel elements had already been designed. All of this preparatory work was done in conjunction with steelwork contractor Severfield-Reeve Structures.

Six months before the main contractor was even appointed all steel elements had already been designed.

"This created a very challenging structural design process during which we had to be very flexible and quick to react to client changes and design development while still meeting the original deadline," Mr Stuart says.

Malcolm Gourley, Deputy Project Manager for main contractor Bovis Lend Lease agrees and says the steel erection programme has obviously benefitted.

"By the time we were appointed as main contractor all steelwork was designed and was already being fabricated. This has quickened the construction process to meet our tight completion date," Mr Gourley adds.

As well as offering a quick time solution for construction, Mr Gourley says steel also offers

more flexibility than alternatives. "By using steel the smaller retail units can be enlarged and combined with adjacent units in the future. If there were concrete walls this reconfiguration wouldn't be possible."

The construction of the Silverburn shopping centre has been divided into two phases. Phase 1 kicked off last year, with steel erection beginning in January. This section approximately accounts for two-thirds of the scheme and includes the two main anchor stores of Debenhams and Marks & Spencer. Roy Barrow, Project Manager of Severfield-Reeve says 7,300t of steel will ultimately be used on Phase 1.

Debenhams' need for an early completion date meant the steel erection programme began on this anchor section. Offering an overall floor space of 11,520m², Debenhams differs from the rest of the project as it has three levels, two retail floors and a third storey for management offices and a rooftop restaurant.

"By using steel the smaller retail units can be enlarged and combined with adjacent units in the future. If there were concrete walls this reconfiguration wouldn't be possible."

The rest of the project is a two-storey braced steel frame split into independent areas over a 600m building length. A composite metal deck and concrete floor slab has been used throughout as this allows for maximum flexibility to form openings

The steelwork erection build up in the Debenhams store doesn't differ from the overall project. Mr Barrow says the typical floor beam build up consists of 710mm high x 450mm wide plate girders on the typical 10m x 12m grids, with 533 UBs predominantly used as the main intermediate floor beams. "The beams are typically 10.5m long," Mr Barrow adds.

A large number of column section sizes are also being used. Mr Barrow says the majority

Above: The main entrance required 3m deep trusses
Below: The 600m long mall will be naturally ventilated via roof-top pods.

Steel erection is ahead of schedule thanks to fast-track construction

of the columns for the retail units are 13.5m long, although longer sections up to 16m in length are being used for the raised roof which covers the shopping centre's mall.

The second area of steel erection to begin was the Marks & Spencer anchor store. It will offer 5,575m² of retail space over two-levels with a grid plan of 10.8m x 10.8m.

Meanwhile, running through the middle of entire 600m-long project is a glass-roofed mall. This has a number of interesting steel elements including a series of 6m-high 'roof pods' installed to enable natural ventilation of the Silverburn centre.

"The pods will provide environmentally friendly and cost efficient air conditioning."

Mr Stuart says: "The pods will provide environmentally friendly and cost efficient air conditioning and they are supported off a series of Stuart McTaggart designed long span shallow depth steel trusses and Fabsec beams spanning over the mall."

Between the pods, a series of smaller 'roof kites' will provide natural daylight and these are supported off a steel frame formed by 700mm deep Fabsec beams. All supporting steelwork for the mall's roof is being supplied by Severfield, while a sub-contract was awarded to Portal, for all roof pod and kite architectural steelwork.

Phase I also incorporates two of the project's main entrances, situated in front of the two anchor department stores. Severfield is supplying a number of large trusses to support the glass roof over two entrance plazas.

According to Mr Barrow, both entrance plazas are formed with 3m deep steel trusses, typically spanning 35m, along with Fabsec beams, and these support a series of steel pods and lights set into the glass clad roof.

"Generally the trusses are fully assembled in our workshop and delivered to site in one piece," Mr Barrow says.

One of the final pieces in the construction process will be a feature 'floating roof' running the entire length of the east (front) elevation overlooking a landscaped walkway and a large car parking area. Mr Stuart says this feature is a complex clad elevation supported by splayed Macalloy circular steel struts.

"Steel raking columns, situated between every second main column span out, away from the main structure," Mr Stuart says. "These then form a V-shaped formation with 7.5m clearance at their widest point."

Situated to the rear of the Silverburn centre is a six-level multi-storey car park. Main contractor for this separate contract was Dunne Building and Civil Engineering, and it used a concrete frame for the majority of the structure. However, one end of the car park sits on top of a service yard and because a column-free area was required, so delivery trucks could have unobstructed access, seven 30m-long steel transfer girders support the roof.

Severfield delivered the transfer girders to site in 15m-long sections, and says it supplied a further 620t of steelwork for this contract.

Meanwhile, phase 2 of the main project is currently just getting under way. This phase will extend the shopping mall and retail units by a further 150m and will also include a large glass-covered winter gardens.

Mr Barrow says this phase will be constructed in an identical manner as Phase 1 with similar column and beam sizes and grid plan. "We'll supply a further 3,500t of steelwork for Phase 2," he sums up. Both phases are scheduled for completion by autumn 2007.

Steel supports the delivery yard beneath the multi-storey car park.

Both buildings feature steel-framed external staircases.

Open plan for city centre campus

An old Newcastle cinema site is the location for a major campus expansion by the University of Northumbria. Steel construction plays a starring role in the production, as Martin Cooper reports.

Westok beams are used throughout

FACT FILE
East Campus Northumbria University, Newcastle-upon-Tyne
Main client: *Northumbria University*
Architect: *Atkins*
Structural engineer: *WSP*
Main contractor: *Sir Robert McAlpine*
Steelwork contractor: *Billington Structures*
Project value: *£47M*
Steel tonnage: *1,500t*

One of the North East's premier seats of learning - Northumbria University - is investing more than £100M in a major expansion and refurbishment programme. Part of this grand scheme involves the construction of a new two-building campus, situated on the site of a former cinema and separated from the existing City campus by the A167(M) motorway.

The new East campus will comprise of an 8,000m² School of Design and a 16,000m² building which will house the School of Law and the Newcastle Business School. The project's masterplan also includes the construction of a pedestrian bridge linking the two sites to create a single, integrated city centre campus.

The site was once occupied by the Warner Cinema, and before that by a goods station. Stephen Jasper, Project Manager for structural engineer WSP explains the nature of the previous tenants meant one of the job's main challenges was the amount of preparatory works.

"Before the foundations for the new buildings went in a vast array of old 7m-long foundations had to be extracted," Mr Jasper says.

Once the site had been cleared and foundations for the new steel-framed structures were in place, steelwork began to be erected early this year.

Mr Jasper says during the planning stages a steel-framed design was chosen because both buildings required an open-plan configuration.

"We wanted as few internal columns as possible, so long beams are used to give us the required spans," Mr Jasper says. "We looked at other materials, but they wouldn't have been viable."

> ***"We wanted as few internal columns as possible, so long beams are used to give us the required spans."***

Another aspect in steel's favour was the fact that the building's original design had to be lowered by approximately 4m. This was to keep the structures in line with surrounding buildings, but this slight architectural alteration meant it was crucial the services be integrated into the floor-ceiling cavities. "Westok beams were the obvious choice as they already have the service holes in them," Mr Jasper adds.

"As you can imagine, as the buildings house university faculties, there is an array of IT cables as well as the usual services," Mr Jasper says.

Both new structures consist of five-storeys and are steel-framed beam and column units. Columns are typically 305UC section, while the Westok beams are generally 900mm deep and 14.5m long.

The larger law and business school building is an eliptically-shaped structure with a 45m width at the middle and an overall length of approximately 100m. Because of this width a completely column-free design was not possible. However, by utilising 14.5m-long beams, Mr Jasper says there are two

A new footbridge will eventually link the new campus with the rest of the University.

sets of internal columns where there would normally be five sets. Consequently, a grid plan of 14m x 6m features in the building throughout its five levels.

The building also has, on its ground level, a two-storey high (9m) entrance lobby and cafe. A central lightwell which extends up from ground floor to roof level is another distinctive aspect, which was formed with curved steel sections.

Sue Capewell, Project Manager for Billington Structures says the lightwell utilised 400 x 200 RHS's that were fabricated off site and bolted together on site.

Meanwhile, the smaller School of Design building does have a completely column-free floorplan. "We were able to achieve the desired open-plan design because this building is only 14m wide," Mr Jasper explains.

Utilising a grid plan of 14m x 6m and 14.5m-long x 900mm deep main beams, the entire building has no internal columns throughout its five levels.

This narrow structure sits opposite its larger neighbour and abuts a retaining wall which runs along the project's northern boundary. Because of this wall, the building's ground level cannot be accessed from one elevation, as it's effectively underground.

The ground level will eventually house the faculties' workshops and minimal use of internal columns was a key requirement of the University.

Above the ground level, the building's first to fifth levels are all set back by 7m, so consequently they have a 50% smaller footprint. The available roof space above the ground level will be turned into a terrace seating area.

Available roof space will be turned into a terrace seating area.

Architecturally, both of the new University buildings will have glass facades wrapped in stainless steel mesh panels that reduce solar gain by up to 50%, preventing occupants from over heating. This double skin construction also allowed the designers to incorporate walkways and handrails for maintenance workers.

Part of Billington Structures' contract included the supply and erection of bowstring trusses which will support the glass and stainless steel facades. Ms Capewell explains that a series of 26m-long external bowstrings will be erected around both buildings to support cladding. "Behind the trusses there are braced steel walkways which we also supplied," she adds.

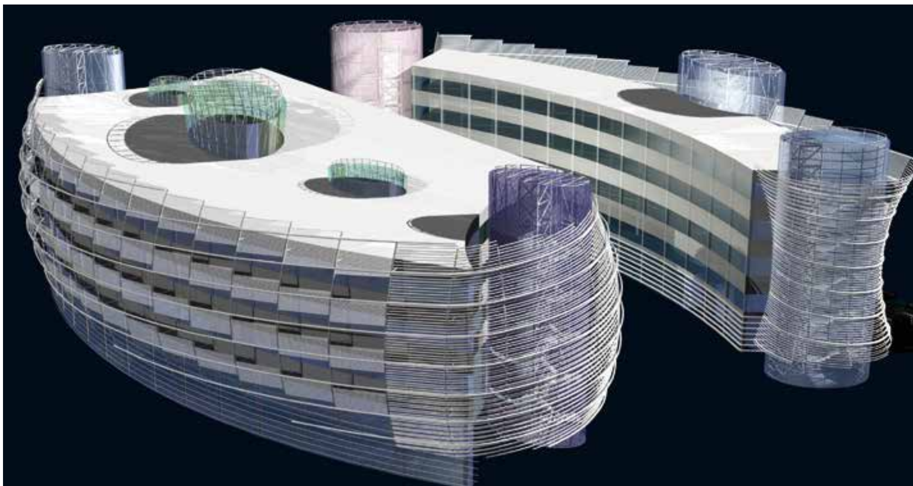
Both buildings also feature two steel-framed staircase cores at either end. These staircases were erected with curved sections and bolted together on site. These external staircases will have glass cladding that incorporates 100mm-diameter aluminium tubes which double as safety handrails and solar shading for users.

According to Natalie Sarabia of architects Atkins, a lot of work has gone into designing the external steelwork and its associated cladding. "We wanted to minimise the amount of sunlight which would penetrate the facade, so solar repellent glass will be used on the main elevations as well as the external staircases."

Once the project is complete, much of the old University campus will be refurbished. The University says this is its largest ever investment programme and will make a significant contribution to Tyneside's future growth and regeneration.

Above: Both buildings are five storey steel-framed structures.

Below: Solar repellent glazing will be used as cladding.



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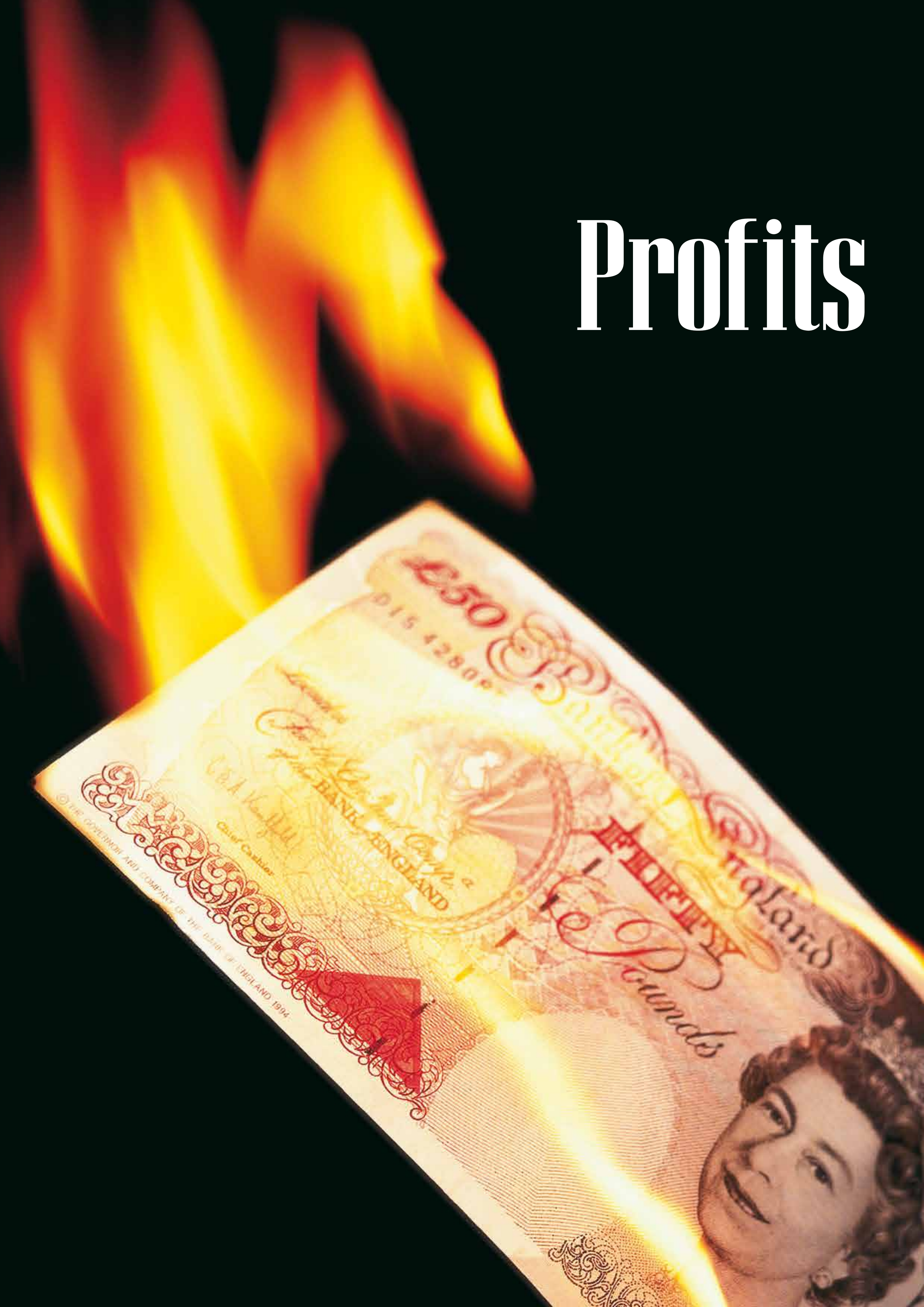
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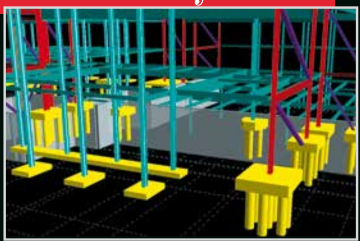

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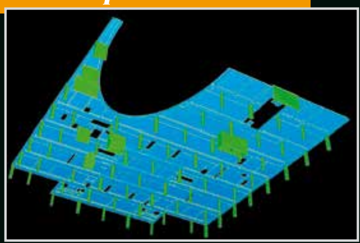

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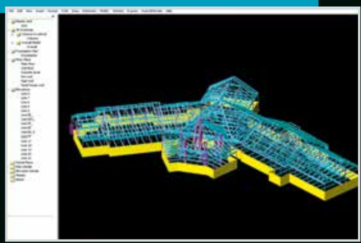

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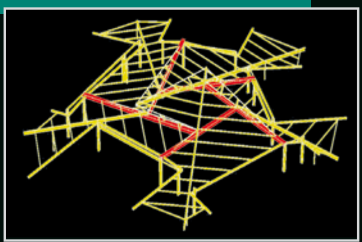

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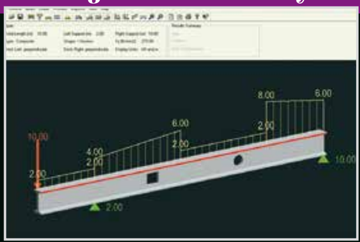

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Prefabricated Glulam timber roof beams are connected to the steel frame.

Steel supports green shed roof

An environmentally friendly distribution centre, currently under construction for Suffolk brewer Adnams is demonstrating the flexibility of steel. Victoria Gough reports.

FACT FILE
Adnams warehouse, Southwold, Suffolk
Main client: *Adnams*
Architect: *Aukett Fitzroy Robinson*
Structural Engineer: *Faber Maunsell*
Main Contractor: *Haymills (Contractors)*
Steelwork Contractor: *A.C. Bacon Engineering*
Steel tonnage: *220t*

An unusual combination of a steel and timber frame has been erected for a new distribution centre, described as one of the greenest of its type in the country. The £5.8M project in Southwold, Suffolk, will provide brewer Adnams with nearly 5,000m^2 of floor space as well as an office area and plant room.

Being constructed by main contractor Haymills, the new distribution centre is due for completion in September 2006. Once operational it will increase Adnams' present capacity and will form the culmination of a seven year investment in the company.

The structural steelwork had to be connected to Glulam roof beams – made up of layers of laminated timber, each 45mm thick, that are glued together to give large complete pieces of timber. These beams had to be over 2m in depth to support the green Sedum roof and are said to be the largest Glulam beams to be used on a construction project in the UK. The beams cantilever 11m over a series of 12m-long steel transfer trusses, which 'pick up' the timber beams at 6m spacings.

A.C. Bacon Engineering supplied and erected the 220t of structural steelwork that make up the frame to support timber roof beams. Director of A.C. Bacon Engineering Neville Howling says: "This building shows the flexibility of steel by being able to combine it with timber."

Steel and timber provide an unusual frame for Adnams' new distribution centre

"Special care was taken in detailing, fabrication and erection of the steelwork especially with the connections to the Glulam roof beams," Mr Howling says. "All of the steelwork connections had to marry up with pre-drilled holes and slots that were put in the roof beams when they were fabricated in Denmark."

The steel frame and timber beams support a roof formed of a living carpet of plants and grass, making it heavier than usual.

The steel frame and timber beams had to support a roof which is formed of Sedum, a living carpet of plants and grass which makes the roof heavier than normal.

Principle Engineer from Faber Maunsell, the project's structural engineer, Danny Wood says: "There was a lot of very close coordination between all parties involved to ensure that each component and connection matched up with the timber roof beams."

The structure will include many environmentally friendly features and it has been predicted an excellent BREEAM (Building Research Establishment Environmental Assessment Method) rating. The building will be clad using lime and hemp blockwork, this will be laid in traditional lime mortar which absorbs carbon dioxide. Lime and hemp infill will provide insulation, regulating the building's internal temperature.

Other green features include the installation of two collector solar panels on the roof that will provide up to 80% of the buildings requirement for hot water. Rainwater will be harvested and used to flush toilets and there will be an onsite foul treatment plant which will clean waste water making it pure enough to return it to a nearby pond.

This year the steel construction industry looks back over one hundred years of success since formation of the British Constructional Steelwork Association. Nick Barrett picks out the highlights of the century of progress.

Celebrating a century of success

Steelwork contractors have felt many ups and downs for their sector of the construction industry during the 100 years since they started to pursue common interests via the BCSA. Seldom have they occupied such a position of importance to the construction industry, and by extension the national economy, as they do now, with shares of over 90% in key market sectors.

Not much is known in detail about those early meetings of five fabricators in the Manchester area in 1906, but they are thought to have confined themselves to exchanges of information about matters like wage rates and the impact of new legislation. This must have been valuable enough in itself because soon the Steelwork Society, as it came to be called, had 40 member companies drawn from the northern counties of England.

The First World War meant many people were too busy for meetings of such associations, but post-war other parts of the country saw the benefits of associating to pursue common objectives and the Midlands Association was formed in 1919. There was also a London based group that held joint meetings with the other two groupings that eventually resulted in the formation of what became the BCSA.

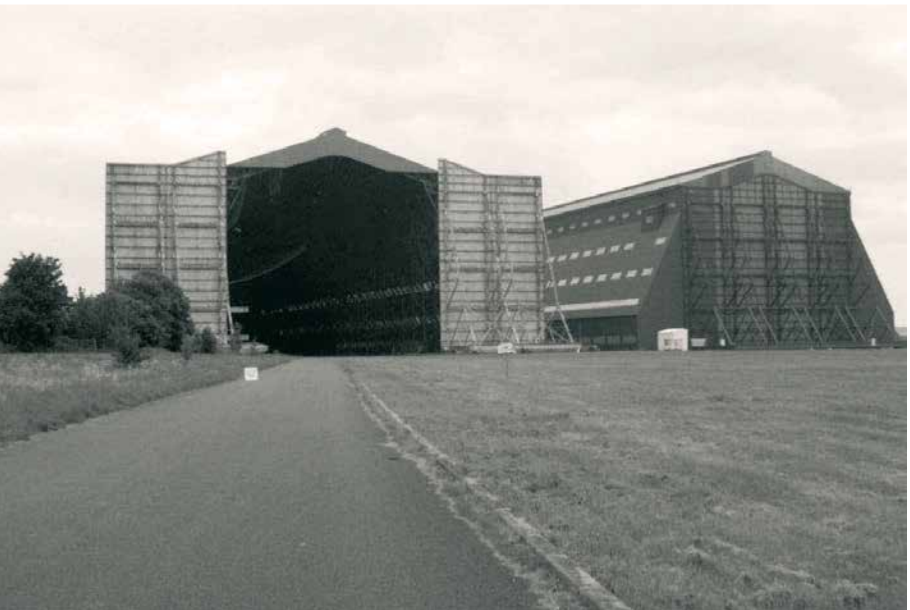
Issues of common concern emerged early on – the threat from reinforced concrete, the need to produce technical solutions to the challenge of fire regulations for example. There was also early recognition of the need to invest in marketing to ensure that specifiers were educated in the advantages of steel.

There were a number of steel producers in the pre nationalisation era eager to compete amongst themselves, but also happy to sell simple fabrications direct to the construction industry and its clients. This was an age of price fixing among steel producers, who fell back on providing fabricated steel as a competitive tool, absorbing much of the cost. Fabricators struggled to compete in parts of the market against fabrications from the steel producers. Fabricators could sometimes buy fabricated steel direct from the mills for less than they could produce fabrications themselves.

Fabricators could sometimes buy fabricated steel direct from the mills for less than they could produce fabrications themselves.

Some of these problems were eradicated when the British Steelwork Association was formed in 1928 supported by both fabricators and steel producers, and dedicated to promoting the constructional use of steel through marketing, publicity, providing technical information and technical research. This effort proved successful and in 1936 the organisation adopted its present title.

The BCSA possessed an in depth technical capability which was eagerly used by many clients. There was a bridgework design department for example that helped local authorities by offering complete designs. This was to be expanded in the 1960's when it developed a world wide reputation for its design advisory service.



Steel was used to frame the famous airship hangars at Cardington

Support for the war effort

The outbreak of war in 1939 led to the total capability of the BCSA and its members being offered to support the war effort. The fabricating industry as

Steel successes: L-R The Ritz Hotel, London. The Shell Building, London. Steel helps with the war effort.

a whole emerged from the war with an enhanced reputation for the skill and determination it threw into the struggle for national survival. At one time the entire drawing office was engaged in converting shipbuilders drawings for use in fabricator's workshops. BCSA organised the fabrication of some 30,000 tonnes of components for the shipyards.

Among the other works handled by BCSA were the Mulberry Harbours, bridges, barges, hangars and hulls for armoured cars. BCSA's role included allocating work in line with national requirements to firms that had the matching capacity and capability. Achieving payments adequate to keep member companies operating was a continual problem which occupied some of BCSA's time during the war years.

At one time the entire BCSA drawing office was engaged in converting shipbuilder's drawings for use in fabricator's workshops.

The post war years saw a flood of new legislation which potentially affected fabricators in many aspects of their business, including health and safety, and the implications of all this had to be learned and then communicated to members. BCSA's role of liaising with government grew accordingly.

Negotiations had to take place regularly with the central authority that still allocated scarce steel between competing demands. Talks also had to be held with steel manufacturers to try and get back to the pre war rolling programmes. The minimum price agreement was a key area where negotiations took place with outside bodies.

Post war situation a worry

Leading players in the fabrication industry realised that the immediate post war position of the industry was not all it could have been. Surveys were carried out to pinpoint industry performance and potential in areas like efficiency, education and training. The response from the wider industry was not as positive as had been hoped, but work to improve performance in these areas continued.

The association's efforts at promoting the image of the industry, through what we would call marketing today, was more immediately successful. Old ex empire captive markets were vanishing and new markets had to be informed about the capabilities of the UK fabricators. Some excellent publications survive from those days showing the achievements of BCSA members worldwide.

The dangers of complacency in the face of a changing world were cruelly revealed in the late 1950's when a sharp downturn in demand led to a shakeout that pushed some of the less efficient firms out of business. This seemed to shock others into taking the action necessary to become efficient providers of constructional steelwork. It also made fabricators take a more realistic look at the sometimes over onerous contract terms they had been happy to sign up to when times were good.

But the pain was keenly felt across the industry, during a period when everything seemed to go wrong at the same time. Inefficiencies in buildings and plant, education and training, productivity, labour relations and management were all cruelly exposed in the new, harsher market conditions. The reinforced concrete manufacturers saw market opportunities and made some inroads. The Monopolies Commission also mounted an investigation at this time, causing further disruption to the smooth running of the industry. Worse falls in demand have since been experienced by the industry and there have even been times of greater upheaval, but at least these days companies fail more because their commercial policies get caught out by the marketplace rather than because of inefficiency or poor equipment.

Price regulation via the legally sanctioned scheme and steel shortages dominated the years that followed. At the start of the 1960's BCSA and steel manufacturers launched a Joint Propaganda Project, which meant hiring specialist staff, producing brochures and a magazine, and organising a programme of works visits for designers and clients. The BCSA's magazine Building With Steel started publication in February 1960 with a 15,000 circulation.

An early technical paper from BCSA

The tacit agreement with the concrete sector not to produce 'knocking copy' against each other's products started to break down in 1961 with publication of a leaflet called 'Why Choose Concrete' that drew comparisons between concrete and steel. Visits were organised to show architects buildings in Paris which were being built in steel and with no fire protection applied.

Three major technical developments helped the industry at around this time; the introduction of high strength bolts which, combined with arc welding, virtually eliminated riveting; the rolling of universal beams and column sizes which helped the export drive; and the development of digital computing.

Technical publications began to flow thick and fast as the industry responded to the thirst for technical information and support from designers. The extensive knowledge about all aspects of the performance of steel in construction that is freely disseminated today by the BCSA and its partners Corus and the Steel Construction Institute for use by structural engineers and architects started to be developed at this time.

Other marketing efforts had to be stepped up to counter aggressive promotion of concrete. The Structural Steel Design Awards was instituted in 1968 and continues to be among the best respected awards in the construction industry. Links were established with universities, efforts to promote exports were stepped up.

The 1970's started with another commercially challenging marketplace and cost cutting was the order of the day again across the industry. The members' levy was cut by 40%. The Constructional Steel Research and Development Organisation (CONSTRADO) was formed in 1971 after talks with the British Steel Corporation (BSC) to provide technical information. Some BCSA technical functions and staff transferred to the new organisation but BCSA retained core technical expertise to advise members and to represent the industry on technical issues.

1976 – an Olivetti P652 computer running a programme for portal frame design.

In the 1980's computers started to enter the design world in numbers and BCSA took a lead in familiarising members with the potential benefits, via a microcomputer loan scheme.

That these efforts were paying off could be seen in 1985 when steel for the first time in 50 years overtook in situ concrete as the most popular form of construction for multi-storey buildings. Constructional steelwork fabricated rose from 700,000 tonnes in 1983 to almost 1M tonnes in 1986.

Also in the 1980's there was a renewed emphasis on producing steel focussed magazines, with BCSA News changing its name to Steel Construction in 1986 with an increased circulation. Press publicity was generated via special supplements in regional daily newspapers.

By the end of the 1980's the BSC had been de-nationalised and had become an efficient producer by world standards. Output of the industry peaked at 1.4M tonnes in 1989.

Two publications from the 1980s

Steel made the Canary Wharf development possible.

Improvements in recent years

The 1990's saw further improvements in the industry's market position, with cash retentions eliminated on steel construction contracts. The association's magazine was merged with the Steel Construction Institute's magazine to be called New Steel Construction, published bi-monthly, and relaunched as a monthly in 2005 with Corus as a partner.

National Steel Construction Week's started to be held in the 1990's. From 1999 a bi-annual steel construction conference and exhibition has been held.

Preparations for the introduction of Eurocodes have been extensive, and design guides are being produced as required. BCSA joined the internet age in 1996 with the setting up of its first website. A major review of BCSA's operations concluded that the association's aim would be to help members improve their business competence and profitability.

In the new century there has been a continued focus on producing technical information and lobbying hard for industry interests at all levels of government and on international bodies. Steel Construction News was launched with a circulation of over 100,000, which is the biggest of any construction industry publication.

Health and safety remains a key theme for BCSA and throughout its history the association has played a leading role in improving safety through publishing guides, liaising with the health and safety authorities and researching the causes of accidents. The constructional steelwork industry today enjoys a highly creditable safety performance, both in fabrication workshops and on site.

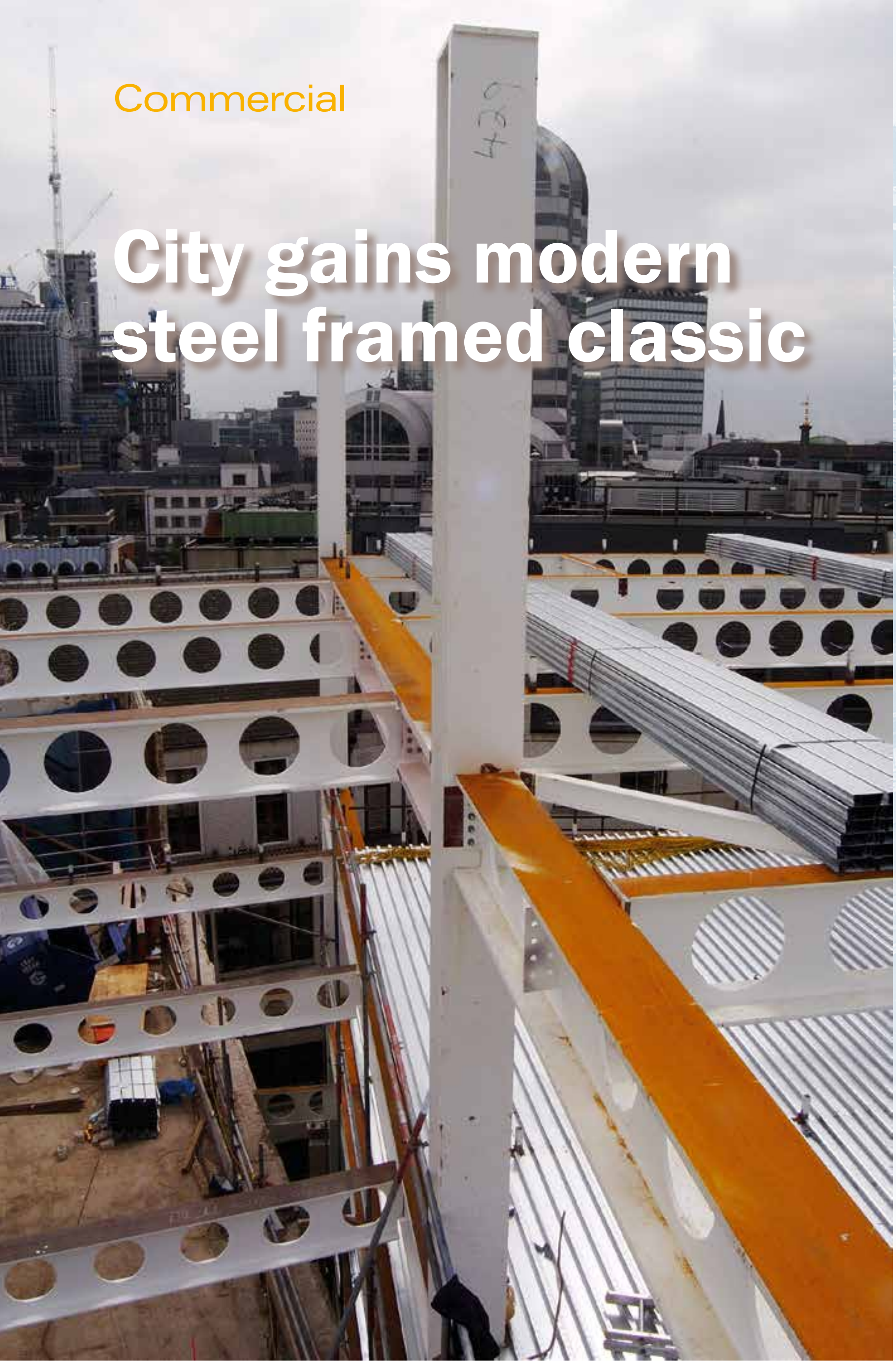
The Steel Construction Sustainability Charter was launched in 2005 to promote development of steel as a sustainable form of construction, and environmentally aware members have not been slow to sign up to it.

In its centenary year the association was reported to be in robust good health, helping members make progress on all fronts and looking forward to a major challenge in helping London in its efforts to get ready for the 2012 Olympic Games.

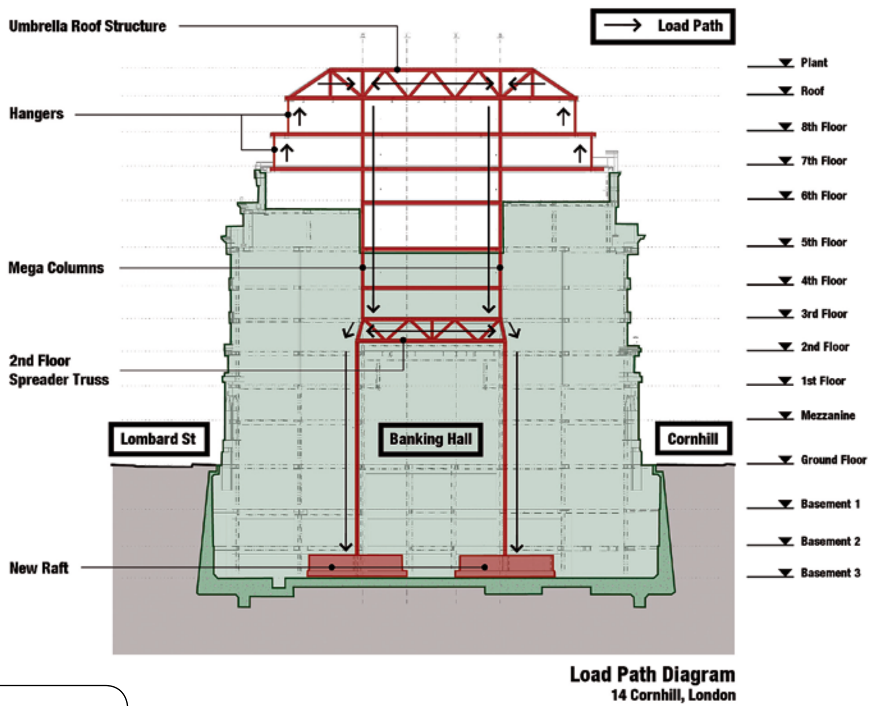
A full history of the industry and BCSA can be read at www.SteelConstruction.org/CenturyOfSuccess

City gains modern steel framed classic

The former London headquarters of Lloyds Bank is undergoing redevelopment involving retention of the original facade with a new steel framed structure being constructed within. Martin Cooper reports.



Above: Two new levels take shape on the structure's roof
Below: The new levels are hung from the steel roof.



Built in the late 1920s, 71 Lombard Street in the City of London was until 2002 the headquarters of Lloyds TSB Bank. However, having relocated to new premises at nearby Gresham Street, and as part of the deal, Lloyds sold the historic site to developer IVG Asticus Real Estate, which is turning it into a prestigious business location offering 125,000 ft sq of office space and 40,000 sq ft of retail space.

The imposing Grade II listed six-storey building sits on a triangular wedge between Lombard Street and Cornhill, near to where both thoroughfares converge on the Bank intersection. A small segment of the plot was taken up by another building - 13-14 Cornhill - which has recently been demolished behind a retained facade, creating a larger project footprint. The site address has now taken on this name and is officially rebranded as 14 Cornhill.

The City of London location has presented some logistical challenges. John Bray, Project Manager for ISG explains: "All deliveries to site have to be planned well in advance as the surrounding streets are extremely busy during peak hours."

"All deliveries to site have to be planned well in advance as the surrounding streets are extremely busy during peak hours."

Lombard Street can be closed to traffic between 10am and 4pm only, but this road is too narrow to accept some loads. Consequently, some of the steel trusses, have to be craned into site from Cornhill. "Here we can close one lane to traffic, but only at night," Mr Bray explains.

Matt Mason, IVG's Project Director describes the project as a re-development within an existing facade. Put simply, the Lombard Street facade is being retained as are all the adjoining floors to a depth of one bay. However, behind this a major demolition job has also been undertaken, including the leveling of 13-14 Cornhill. What's left of the original building will be incorporated into a new build section and then enlarged to eight storeys.

Areas to be retained consist of the ground floor listed banking hall, the listed imperial main staircase and wood-paneled meeting rooms on the fifth floor. Mr Mason says the banking hall will either be let as a retail arcade or restaurant/dining environment. The hall also includes a mezzanine floor which overlooks the hall on two sides.

The original Lloyds building is a steel framed edifice and the new and bigger structure is also being predominantly constructed with steel. However, the entire construction process is quite complicated to say the least. To summarise: the developers want to create a viable modern office and a significant increase in usable space was required. So two new floors will be added to the building, and to avoid any damage to existing floors six mega-columns have been inserted that support a number of steel trusses at roof level from which the new floors will then be suspended.

"Much of the building is upside down in a structural sense with loads being carried up the building to long span, storey deep roof trusses before they are taken back down the mega-columns," Eddie Jump, Project Associate of whitbybird explains.

"Much of the building is upside down in a structural sense…"

"Understanding the existing structure and steelwork, and then combining this with the new steelwork has been one of the main challenges of the project," Mr Bray says.

Floor area will be further increased by filling in the lightwell above the banking hall. Meanwhile, between the first and fourth levels, wide brick-clad low-grade steel columns are being replaced with slim solid steel columns to create a more open-plan environment.

"The only viable method of in-filling the lightwell was by using steel beams," Mr Jump says. He comments the scheme's principle is to keep as much of the original building as possible. To this end steel was deemed to be the ideal material.

"The only viable method of in-filling the lightwell was by using steel beams"

"The two new floors are basically hung from a layout of trusses in the form of a giant umbrella, this wouldn't have worked without using steel," Mr Jump adds. "The weight savings of steel are very important."

All steelwork for the project is being supplied and erected by Graham Wood Structural. Gregor Hunter, Operations Director for Graham Wood estimates that 900t will be used on the main structure with a further 300t for the construction of the new section on Cornhill.

Mr Hunter says the process of inserting the lower levels of the 50m-high mega-columns was a very complicated job, as they were craned into the building and dropped through holes in existing storeys in sectional 11m lengths.

Two of the six mega-columns rise through the old lift shaft and are UC 356mm x 402mm, while the other four fabricated plate units measure 300mm x 300mm. All start at sub-basement level, however four mega-columns - the ones not in the old lift shaft - change configuration at level 2 of the building. Up to this point they are in pairs, which were inserted either side of the existing columns. Once the mega-columns were in place and before the transfer beams were inserted, the old columns above had to be removed. "This kind of procedure isn't unknown, but it is very complicated, involving our design and installation of temporary works to support the existing third to sixth floors," Mr Hunter explains.

Mr Jump says the construction of two extra floors literally rests on the mega-columns. "The retained banking hall slightly constrains these columns," he says. "So, after by-passing the hall at level 2, they slightly kick-in and are replaced by single mega-columns."

At level 2, a transfer beam rests on the columns and this in turn supports a truss. From here the new single mega-columns reach up to the new roof above level 8. On top of the columns at this height are another series of very large trusses which span over the existing wings of the building and the two new floors are suspended from these.

The large trusses vary in size and depth, with the largest central unit weighing 15t and 13t at the wings. Mr Hunter says that 240t of steel is being supplied for trusses alone.

The new eight storey building not only covers the old buildings' floor space but also incorporates a new steel frame structure which replaced the demolished Cornhill building. The new floorplan also consists of the in-filled lightwell from level 2 to the level 6. To complete this in-fill Graham Wood Structural installed a number of Westok 9t 15m-long beams overlaid with metal decking.

Another interesting aspect of the project is the new sloping rear glass elevation which is also suspended from the roof trusses. To form this a number of raking 254 x 254 x 89 columns are hung from the overhead trusses.

Mr Jump says the design of this elevation, that hangs over six entire floors overlooking Change Alley, had to take into consideration any structural movement. "The complete elevation is steel framed and clad with glass. To get the cladding designed we had to get a key understanding of the building's movement."

In order to increase the floorplan for the new building, Graham Wood is removing 50 existing columns. The old units are 1 ft sq brick-clad columns and are being replaced with steel columns, to create a 'visual feel of more space'. These columns extend from the first floor to the underside of level 5.

The columns to be replaced are in the old structures two retained wings, and Mr Hunter says more than 30t of temporary steelwork is being installed for this part of the project.

"The temporary works, such as jacks and props, are holding the existing building up as the columns are replaced."

"This is one of the biggest challenges of the whole project," Mr Jump sums up. "The temporary works, such as jacks and props, are holding the existing building up as the columns are replaced. This is a key procedure of the project," Mr Jump adds.

The 14 Cornhill project is scheduled for completion by the third quarter of 2007. As IVG says, a modern steel-framed classic in the heart of The City will have been created from an existing structure.

Top: Steel delivered to site
Above: The listed Imperial Staircase.

FACT FILE
14 Cornhill, London
Main client: IVG Asticus Real Estate Ltd
Architect: DLG Architects
Structural engineer: whitbybird
Project manager: Buro Four
Construction manager: ISG interior/exterior
Steelwork contractor: Graham Wood Structural
Value: £47.5M
Steel tonnage: 1,200t

The manufacture of structural sections used in the construction of the new OCS stand at the Brit Oval cricket ground utilised steel recycled from an old steel mill at Teesside. A brochure describing the recycling of the steel mill is available from www.corusconstruction.com

Sustainable steel construction: the facts

Sustainability and steel construction go together more intimately than many might realise. Martin Cooper outlines the sustainability case for steel in the age of global warming and increasing environmental concern.

Minimal waste with recycling

Recent legislation to protect the environment and reduce waste, such as the landfill tax, mean that landfilling of building waste is no longer acceptable. Instead, construction and demolition waste is increasingly thought of as a resource that can be recycled into new products. The steel construction sector leads the way when it comes to recycling. Unlike most other common construction products, scrap steel has a significant economic value that ensures that it is recovered and either reused or recycled. Research has shown that 94% of all steel construction products are either reused or recycled when buildings are demolished, and this is likely to increase.

Scrap steel has a significant economic value

Steel has been recycled for centuries and most countries have efficient infrastructure in place to collect and process scrap. Globally some 400M tonnes of steel are recovered and recycled annually, representing about 40% of the total world production. Within a sustainability context, recycling steel eliminates waste and avoids the environmental impacts associated with producing new products from virgin sources. Unlike many other construction materials, steel has the advantage that it can be recycled, again and again, into new products with little or no change in its inherent properties.

Research carried out by the Steel Construction Institute (SCI) has estimated that there is around 100M tones of steel in buildings and infrastructure in the UK. This stock of steel is an important and valuable material resource that will be reclaimed and either reused or recycled in the future.

Steelwork that arrives on site is utilised in the structure with zero waste

Offsite construction aids safety and speed One of the main advantages of constructional steelwork is offsite manufacture, which is more efficient, faster and safer than traditional site construction. Offsite manufacture was encouraged by Sir Michael Latham in the Latham Report and has been a feature of Rethinking Construction. The benefits include enhanced quality control, dimensional accuracy, reduced construction time on site and overall programme savings. Environmentally, offsite construction generates less waste and also creates less noise and disruption for local residents. There are also social benefits connected with offsite construction, as a permanent and stable factory workforce will benefit and contribute to the local community. All steel construction products rely on offsite manufacture, from standard structural sections to fully fitted-out steel modules, all of which are made offsite and delivered to site pre-engineered and quality assured. Because the steel sector uses just-in-time production and deliveries, offsite manufacture means site logistics are improved, which leads to better safety and less risk of damage to goods stored on site. Fewer materials and products stored on site eases site congestion and can speed up the entire construction process, particularly on congested urban sites.

South Cambridgeshire's district office (top and bottom) in Cambourne features a number of elements that contribute to its energy efficiency.

Fabric energy storage improves efficiency

Fabric Energy Storage is the process whereby the structure of a building is used to absorb excess heat during the day. This heat is then purged at cooler times. Used well, the process can significantly reduce or eliminate energy requirements for cooling. Studies have shown that using fabric energy storage can decrease daytime peak internal temperatures by 3-5°.

Because of the physical limitations on the amount of heat which can be absorbed by the building structure however, it is not necessary or practical to design buildings with large mass to take advantage of the phenomenon. Research carried out at Oxford Brooks University has shown that the capacity is maximised if the floor is greater than 100mm thick.

Using fabric energy storage can decrease daytime peak internal temperatures by 3-5°

A recent example of the use of fabric thermal storage to improve energy efficiency has been demonstrated in the South Cambridgeshire district council building in Cambourne. The structure is a four-storey steel-framed building with exposed hollowcore pre-cast concrete planks. In addition to open plan offices, the council accommodation also includes a Council chamber, meeting rooms, library and staff restaurant.

The plan form with a central street allows the offices to be naturally ventilated. This stack effect of the street causes the rising hot air to draw in fresh air across the working areas. Hot air is expelled in summer or mechanically extracted with heat recovery in the winter.

Adaptability and reuse of steel

To be more sustainable, it is important that buildings are designed to accommodate future changes. By doing so, they will last longer and greater value will be extracted from the resources invested. It is estimated that UK businesses currently spend more than £2,000M per year on moving people or departments in response to organisational change in commercial buildings.

One solution to reduce this often unnecessary cost is to provide a column-free, uninterrupted floor which gives users flexibility to reconfigure internal areas. This can be achieved most economically by using steel structures to create the required long spans.

Another solution can be to enlarge a building, which is relatively simple with a steel framed structure when compared to a concrete structure. Difficulty in adapting buildings to change often leads to their premature redundancy, subsequent demolition and the need to dispose of unwanted demolished materials.

Structural steelwork's long clear spans for floors and roof provides maximum flexibility of layout

Design of Mono-symmetric and Asymmetric Sections in Compression using BS 5950-1:2000

by Charles King, Senior Manager Codes and Standards at the Steel Construction Institute

1. MONO-SYMMETRIC AND ASYMMETRIC SECTIONS IN COMPRESSION

1.1 Introduction

Mono-symmetric and asymmetric sections are all prone to torsional-flexural buckling, as shown in Figures 1 and 2. In many sections, particularly those shown in Figures 1 and 2, torsional-flexural buckling is the critical mode of buckling, even worse than pure minor axis buckling. This article explains how the resistance to torsional-flexural can be calculated using BS 5950-1:2000. An introduction to both torsional and torsional-flexural modes of buckling is given in *Design of Cruciform Sections using BS 5950 1:2000* in the April 2006 issue of New Steel Construction. In that article, both modes of buckling are described and design equations are given for pure torsional buckling of sections in which the centroid coincides with the shear centre.

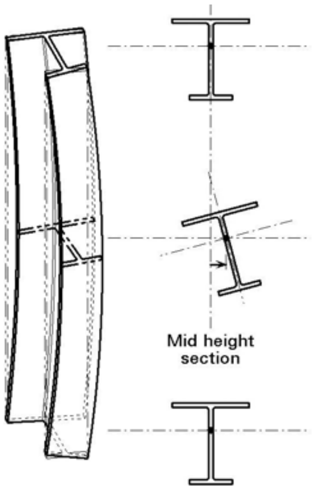


Figure 1. Mono-symmetric section

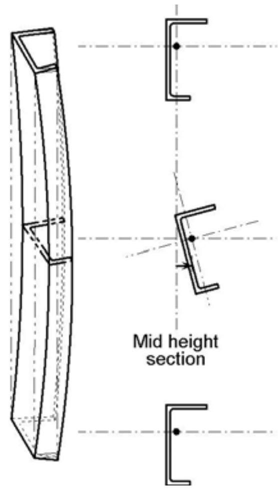


Figure 2. Asymmetric section

The susceptibility to torsional-flexural buckling depends on the position of the centroid of the section relative to the shear centre. Sections in which the shear centre does NOT coincide with the centroid will be prone to torsional-flexural buckling and this should be expected to be the critical mode of buckling for a given effective length. Sections in which the shear centre DOES coincide with the centroid will NOT be prone to torsional-flexural buckling provided that both flanges are effectively restrained at the same points along the member. (In the case of angles, channels and tees, flexural-torsional buckling is effectively allowed for in BS 5950-1 by the slenderness calculations to 4.7.10 and Table 25.)

In sections that are mono-symmetric, the buckling in the plane of symmetry of the section is not affected by torsional components of deflection, as shown in Figure 3. When a mono-symmetric section buckles out of the plane of symmetry as shown in Figure 4, the buckling resistance is less than simple flexural buckling because of the additional torsional components of the deflection.

1.2 Does it matter?

Flexural-torsional buckling will not be critical in bi-symmetric I-sections (eg UCs) with both flanges restrained at the same points along a member. However, where the flanges are not equally restrained, flexural-torsional modes may be the critical modes.

For all mono-symmetric and asymmetric sections, flexural-torsional buckling is likely to produce a mode of buckling lower than the flexural buckling (or strut buckling) modes normally checked by designers.

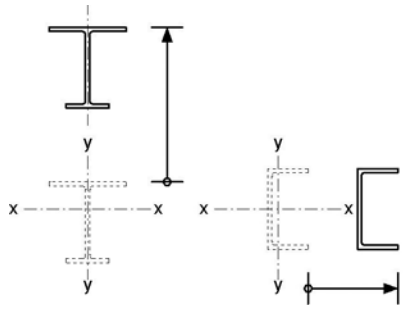


Figure 3 Mono-symmetric sections – buckling in the plane of symmetry

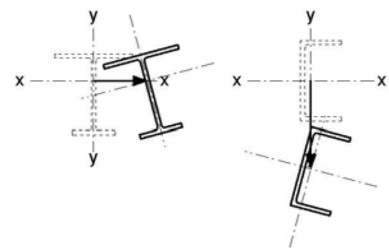


Figure 4 Mono-symmetric sections – buckling out of the plane of symmetry

1.3 What can a designer do?

There are three options open to designers.

The first option is to avoid the problem by using appropriate sections and restraint arrangements. It is simplest to resist compression either by UCs with both flanges equally restrained or by hollow sections. As stated above, these do not suffer from torsional-flexural buckling.

If sections prone to torsional-flexural buckling must be used, then the option of simplifying the calculations should be considered. For example, in the case of an I-section with different flange widths, the section may be thought of as two T-sections with half the web attached to each flange, as shown in Figure 5. Then the lowest compressive strength, p_c, from either of the two T-sections may be taken as the compressive strength for the whole section for buckling out of the plane of the web.

If the problem cannot be avoided, nor the calculations simplified by considering T-sections, the compressive strength for the torsional-flexural mode should be calculated and compared with the compressive strength for flexural buckling. The compression resistance of the member should be calculated using the lowest compressive strength.

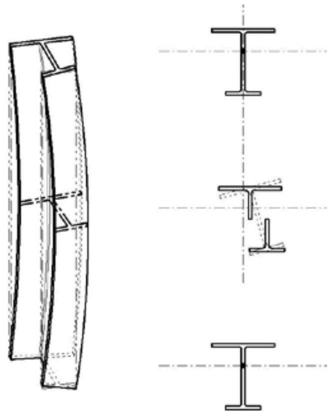


Figure 5 Simplification of the behaviour of a mono-symmetric section as two T-sections

2. COMPRESSIVE STRENGTH

2.1 Use of the elastic critical buckling stress

As described in the previous article, the compressive strength can be calculated from the elastic critical buckling stress, following the procedure in Annex C of BS5950-1:2000. However, it is more convenient to calculate the equivalent slenderness, λ, from the equation in Annex C and then find p_c directly from tables in the Standard.

Annex C gives $p_E = \pi^2 E / \lambda^2$. Therefore, λ can be found from $\lambda = \sqrt{\dfrac{\pi^2 E}{p_E}}$. In the case of torsional-flexural buckling, the value of p_E to be used is the value of p_{ETF} calculated from the equations given below. This allows the designer to use Table 24 of BS 5950-1:2000 to find p_c easily.

2.2 Calculation of the elastic critical buckling stress

The elastic critical load for torsional-flexural buckling can be found in classic references such as *Timoshenko, Strength of Materials, Part 2* or *Timoshenko and Gere, Theory of Elastic Stability*. The elastic critical buckling stress is simply [elastic critical load]/area. The formulae below are written in the symbols in BS 5950-1 but with the BS 5950 1 symbol p_E for the elastic critical stress written to distinguish between four different modes of buckling as follows:

p_{Ex} is for flexural buckling about the x axis,
p_{Ey} is for flexural buckling about the y axis,
p_{ET} is for torsional buckling and
p_{ETF} is for torsional-flexural buckling.

Solving for the general case of torsional-flexural buckling is unpleasantly complicated because it requires the solution of a cubic equation. Solving for the case of mono-symmetric sections is less complicated. Therefore it is convenient to give the solutions for mono-symmetry and for the general case separately.

The axes used in the formulae are the principal axes. In the case of mono-symmetric sections with the plane of symmetry in either the x axis or the y axis, the principal axes are the rectangular axes normally used by designers.

Mono-symmetric sections symmetric about the y axis.

This is the torsional-flexural mode for the common case of I-sections with unequal flanges and symmetrical about the plane of the web, as shown in Figure 1:

$$p_{ETF} = \frac{1}{2B}\left[\left(p_{Ey} + p_{ET}\right) - \sqrt{\left(p_{Ey} + p_{ET}\right)^2 - 4Bp_{Ey}p_{ET}}\right]$$

Mono-symmetric sections symmetric about the x axis

This is the torsional-flexural mode for channel sections with equal flanges:

$$p_{ETF} = \frac{1}{2B}\left[\left(p_{Ex} + p_{ET}\right) - \sqrt{\left(p_{Ex} + p_{ET}\right)^2 - 4Bp_{Ex}p_{ET}}\right]$$

Asymmetric sections

The elastic critical stress, p_{ETF}, must be found by solving the cubic equation:

$$r_0^2\left(p_{ETF} - p_{Ey}\right)\left(p_{ETF} - p_{Ex}\right)\left(p_{ETF} - p_{ET}\right) - p_{ETF}^2\, y_0^2\left(p_{ETF} - p_{Ex}\right) - p_{ETF}^2\, x_0^2\left(p_{ETF} - p_{Ey}\right) = 0$$

where

$$B = \frac{I_x + I_y}{I_x + I_y + A\left(x_0^2 + y_0^2\right)} = \frac{r_x^2 + r_y^2}{r_x + r_y^2 + x_0^2 + y_0^2}$$ in which,

I_x is the second moment of area about the x axis
I_y is the second moment of area about the y axis
A is the gross area
x_0 is the distance parallel to the x axis between the centroid and the shear centre. In sections symmetric about the y axis, $x_0 = 0$
y_0 is the distance parallel to the y axis between the centroid and the shear centre. In sections symmetric about the x axis, $y_0 = 0$.
r_x is the radius of gyration about the x axis
r_y is the radius of gyration about the y axis
$r_0^2 = r_x^2 + r_y^2 + x_0^2 + y_0^2$

$$p_{Ex} = \frac{\left(\dfrac{\pi^2 EI_x}{L_x^2}\right)}{A} = \frac{\pi^2 E}{(L_x / r_x)^2}$$

$$p_{Ey} = \frac{\left(\dfrac{\pi^2 EI_y}{L_y^2}\right)}{A} = \frac{\pi^2 E}{(L_y / r_y)^2}$$

$$p_{ET} = \frac{1}{I_0}\left(GJ + \frac{n_T^2 \pi^2}{L_T^2} EH\right)$$

where
L_x is the effective length of the member for buckling about the x axis
L_y is the effective length of the member for buckling about the y axis
L_T is the length of the member for torsional buckling
n_T is the number of half-sine waves along the outstands of the member for the torsional buckling mode. For members restrained at both ends, this should be taken as 1.0 unless you are sure you can prove it is greater. For cantilever columns this should not be taken as greater than 0.5.
E is Young's modulus
I_0 is the polar moment of area with respect to the shear centre of the section= $I_x + I_y + A(x_0^2 + y_0^2)$
G is the torsional modulus
J is the torsional constant,
and
H is the warping constant

2.3 Selection of the buckling curve

Where there is torsional-flexural buckling, the buckling involves a component of flexure of the flanges similar to minor axis buckling. Therefore the buckling curve should normally be selected from Table 23 of BS 5950-1:2000 for minor axis buckling.

3. COMBINED AXIAL COMPRESSION AND BENDING

The resistance to combined axial and bending can be checked using the clauses of BS 5950 1:2000 in the normal way, but using the values of compression resistance calculated for torsional-flexural buckling where appropriate. For example, when checking an I-section with unequal flanges as shown in Figure 1 with Clause 4.8.3, the value for P_{cy} should be calculated using the compression strength for torsional flexural buckling if this is less than the value for ordinary flexural buckling about the y axis.

The most common asymmetric beams are I-sections with unequal flanges. BS 5950 1:2000 gives methods to calculate the lateral torsional buckling of these beams in Clause 4.3.6. The main difference from bi-symmetric I-sections is the calculation of "v", which is given in Clause 4.3.6.7. For beams with unequal flanges, this requires the calculation of the flange ratio η.

New and Revised Codes and Standards

(from BSI Updates April 2006)

UPDATED BRITISH STANDARDS

BS EN 1990:2002
Eurocode. Basis of structural design.
AMENDMENT 1

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT

06/30107794 DC
EN 14399-8 – High strength structural bolting for preloading. Part 8. System HV. Hexagon fit bolts and nut assemblies.

06/30146463 DC
ISO 22111 – Basis for design of structures.
General requirements

06/30146489 DC
ISO 10137 – Basis for design of structures.
Serviceability of buildings and walkways against vibrations

DOCUMENTS NOT ISSUED AS DPCs

prEN 1993:-
Eurocode 3. Design of steel structures
prEN 1993-1-6
Strength and stability of shell structures
prEN 1993-1-7
Strength and stability of planar plated structures subject to out of plane loading
prEN 1993-1-12
Additional rules for the extension of EN 1993 up to steel grades S 700

prEN 1993-4:-
Silos, tanks and pipelines
prEN 1993-4-1
Silos
prEN 1993-4-2
Tanks
prEN 1993-4-3
Pipelines
prEN 1993-5
Piling
prEN 1993-6
Crane supporting structures

CEN EUROPEAN STANDARDS

EN 1993:-
Eurocode 3. Design of steel structures
EN 1993-1-1:-
General rules and rules for buildings
CORRIGENDUM 1: February 2006 to EN 1993-1-1:2005

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Disproportionate Collapse & The Revised Building Regs	20 June-06	Leeds
Composite Design	22 June 06	Cardiff
Frame Stability	27 June 06	Manchester
Connection Design workshop	4 July 06	Milton Keynes
Portal Frame Solutions	11 July 06	Cardiff
Disproportionate Collapse & The Revised Building Regs	5 Sept 06	London
BS5950-1: 2000 - Understanding the Essential Principles	12 - 13 Sept 06	Dublin
Excel for Engineers	26 Sept 06	Ascot
Disproportionate Collapse & The Revised Building Regs	3 Oct 06	Birmingham
Multi-storey Steel Framed Structures	10 Oct 06	Dublin
Portal Frame Solutions	17 Oct 06	Leeds
Welding for Engineers	7 Nov 06	Dublin
Composite Design	14 Nov 06	Glasgow
Vibrations	21 Nov 06	Bristol
Welding for Engineers	23 Nov 06	Birmingham

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Steel: The Show 2006	26 July 06	St Davids Park Hotel, Chester
Steel: The Show 2006	06 September 06	Holland House Hotel, Cardiff
Steel: The Show 2006	17 October 06	The Culloden Hotel, Belfast
Steel: The Show 2006	1 November 06	Cavendish Conference Hotel, London
Steel: The Show 2006	13 Dec 06	Thorpe Park Hotel, Leeds

Building with Steel

New trends in architectural design

Growing use of exposed steelwork — Sevenoaks General Hospital

The building embodies a number of quite strikingly original architectural features and in many ways blazes a new trail, especially in the use of exposed steel.

The £250,000 two storey building housing the new Outpatients and Maternity Departments of Sevenoaks Hospital, Kent, is of outstanding architectural interest. The clean, sharp lines of the elevation are striking, the effect being accentuated by the intelligent use of exposed steelwork. The modern look of the exterior is emphasised by the unusually large white vitriolite cladding panel units and the neat manner in which they are mounted.

The building is steel framed and the fully exposed steelwork enhances the natural beauty of the building. This feature controlled the type of fenestration and cladding employed and ruled out the use of factory-made prefabricated units. Instead, the glazing and panels were mounted in framing built on site from individual members supplied precut to length and this meant that, in order to ensure accurate fitting of the members, the column spacing had to be kept within limits of $\pm\frac{1}{16}$ in., an exceptionally close tolerance for work of this nature.

The sequence of construction was as follows. The 8 in. by 8 in. by 31 lb/ft external universal columns and 8 in. by 8 in. by 35 lb/ft internal universal columns were erected first, followed by 21 in. by $6\frac{3}{4}$ in. castellated beams at roof level and 27 in. by $7\frac{1}{2}$ in. castellated floor beams: the roof was then added and the reinforced concrete floor cast at first floor level. Use was made of the castellated beams to accommodate services. The first floor beams were secured to the columns with high strength friction grip bolts: all other connections through the building were welded.

The tee and angle framing on the elevation was next welded to the main columns and this is where accuracy of column spacing became vitally important because the framing had to be as accurate as jig-made prefabricated units ($\pm\frac{1}{32}$ in.) in order to accommodate the in-fill panels supplied to site ready cut to size.

The scheme adopted for fitting the glass and in-fill panels immediately after completion of framing was simple, neat and speedy. They were merely pushed into neoprene gaskets inserted around the framing; they were held securely and no other fixing was necessary. To permit the use of standard gasket sections recesses were milled along the inner flanges of the main columns to reduce their thickness to that of the adjoining framing.

Because of the speed with which the glazing and panels could be fitted it was possible by careful phasing to complete the exterior of the building as soon as the frame, floors and roof were in position, enabling work inside the building to proceed without interruption during the winter months. It is thought that this is the first time in this country that the elevation of a building has been constructed in the manner described above.

Because all steelwork on the exterior is fully exposed great care was taken to ensure a smooth and neat finish: all joints were shop prepared by grinding and the welds were ground on site both for the sake of appearance and to ensure accurate fitting of the panels. The exposed steelwork was supplied shot blasted and primed and, on site, was given two coats of stainless steel enriched sealer giving full corrosion protection.

Ingenious design at the Sexton Memorial Gymnasium, Nova Scotia Technical College

After careful analysis of the factors involved, steelwork was chosen in preference to other materials for the construction of this sports hall in Halifax, Nova Scotia, Canada. As this was an engineering campus, it was felt that the design should be 'structurally unique', provided it wasn't too expensive.

This requirement for structural uniqueness to a limited budget became the prime objective for the architects and consulting engineers: Duffus, Romans, Single and Kundzins. They met it by adapting a rigid steel frame to an elliptical plan form and a curved roof configuration on the major axis, providing clear spans of 130 ft. in one direction and 90 ft. in the other. The shape of the roof – with its exposed curved steel purlins and steel deck – was intended to express the imaginary curve formed by a flying basketball.

It was the fixed size and shape of the basketball court on the main floor that was the main factor responsible for the choice of an elliptical plan form, a shape providing a compact and economical solution to the layout problem. Even after making allowance for the complications arising from the elliptical plan and curved roof, the design using steelwork was cheaper than the alternative arched concrete design considered. Another factor favouring steel work was the possibility that construction would have to take place during the winter. The 77 tons of steelwork was fabricated in 14 days and erected in ten.

In order to blend in with existing buildings on the campus, concrete, light brown brick and translucent plastic panels were used for the exterior. Inside the main floor the exposed steelwork of the ceiling and the undersurface of the corrugated steel deck are painted.

AD 301
The use of Annex I1 of BS 5950 -1: 2000.

For Class 1 and 2 sections, Clause 4.8.3.1 allows the alternative of using Annex I1 to check the buckling resistance of compression members with moments instead of using the various equations in Clause 4.8.3.3. Annex I1 uses the plastic resistance of members in its buckling resistance checks and gives higher capacities for buckling of stocky members than would be obtained by using the equations in Clause 4.8.3.3.

Annex I1 has been implemented in various commercial softwares and Figure 1 shows the slenderness range for 'stocky members' where Annex I1 may be used to advantage. A combined plateau length λ_{r0} is determined in Annex I1 which takes into account the actual flexural and lateral torsional buckling effects on the member. In addition, a combination of the two buckling curves shown in Figure 1 is used in Annex I1.

The three conditions that need to be satisfied in order to use Annex I1 are as follows:

1. The member or segment must have a double symmetric cross-section over its entire length.
2. The member cross section must be classified under the action of applied moment(s) and axial load as either Class 1 plastic or Class 2 compact.
3. At least one of the relevant slenderness, λ_x, λ_y or λ_{LT}, of the member must be less than 85.8ε.

Annex I1 covers 'stocky members' and although no clear definition is given, when the above 3 conditions are satisfied, the member or its segments may be said to be stocky. If the cross-section is classified as either Class 3 or Class 4, Annex I1 may not be used to determine its resistance to buckling because these sections are incapable of developing plastic resistances.

The value of 85.8ε is the slenderness where the nominal yield strength (p_y) equals the Euler buckling stress, as shown in Figure 1. When the slenderness of a member or segment is greater than 85.8ε, the equations in Annex I1 revert to those in Clause 4.8.3.3 and no increase in capacity is gained. Careful reading of Annex I1 will show that it is acceptable for a member or segment to comply with the slenderness limit of 85.8ε about only one axis and to demonstrate increased capacity about this one axis alone.

Care should be exercised in interpreting the results of an Annex I1 buckling check in comparison to a clause 4.8.3.3 check and in particular to the simplified method in clause 4.8.3.3.1. It is not possible to directly compare the results or unity factors from an Annex I1 check and a clause 4.8.3.3 check.

Clause 4.8.1 states that 'The buckling resistance of the member may be assumed to be unaffected by shear' and therefore it is not necessary to determine whether the member is subject to low or high shear in order to apply either clause 4.8.3.3 or Annex I1.

Although Annex I1 uses the plastic resistance of members in its buckling resistances equations it should not be used to check the buckling of a segment in a member adjacent to a plastic hinge as a substitute for clauses 5.3.3, 5.3.4 or Annex G. Likewise, Annex I1 should not be used to check columns in simple construction as a substitute for clause 4.7.7.

Many questions have been asked concerning the different slenderness used in Annex I1. The calculation process starts with λ_x λ_y and λ_{LT} and these are clearly defined in the code. A combined slenderness λ_r, accounting for the actual flexural and lateral torsional buckling effects on the member or segment is determined, but this is not the same as λ_r in Section 5 concerned with in plane stability of continuous structures.

Compression members with moments must also satisfy a cross-section capacity check in accordance with clause 4.8.3.2. Clause 4.8.3.2 b) permits the alternative of using the 'More exact method' in clause 4.8.2.3 for Class 1 plastic or Class 2 compact sections. In cross-section capacity checks it is necessary to take account of high shear in calculating the resistance of members.

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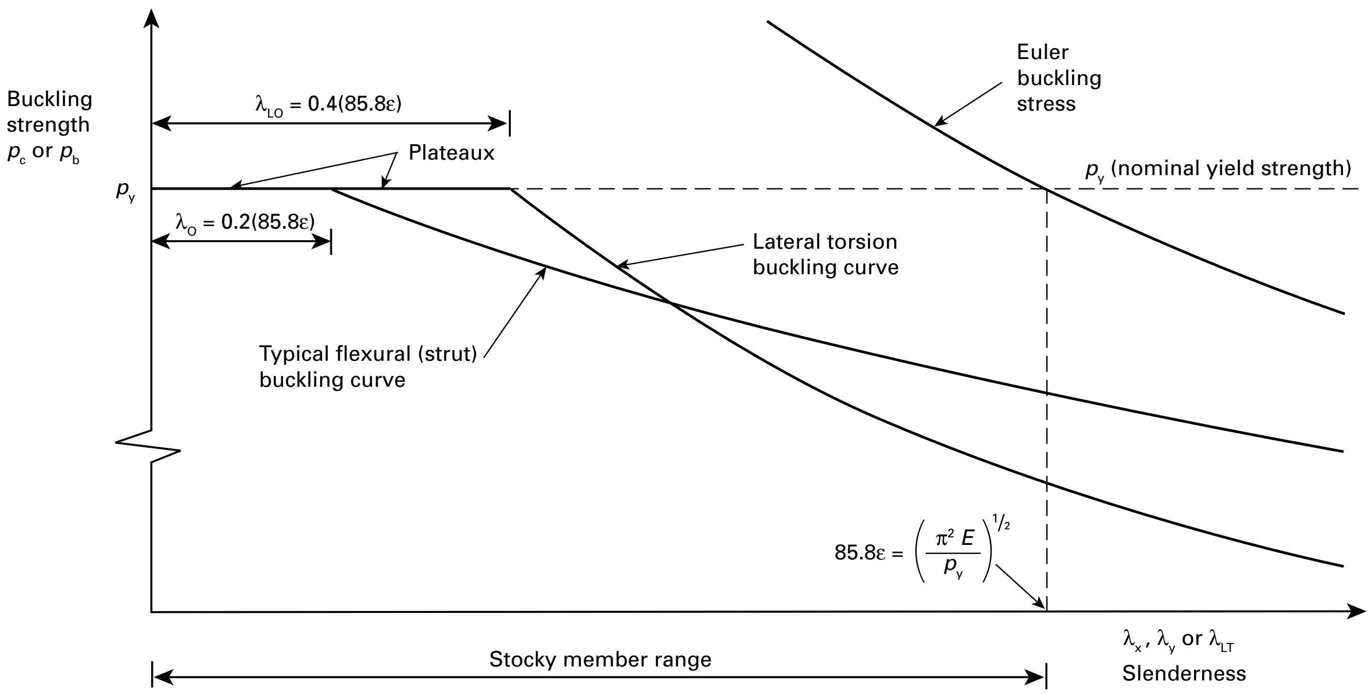

Figure 1 Slenderness Range for Stocky Members

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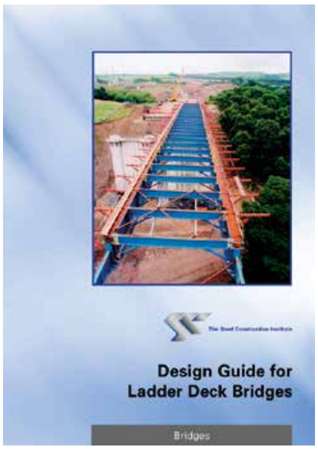

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Design Guide for Ladder Deck Bridges

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

BCSA is the national organisation for the steel construction industry; its member companies undertake the design, fabrication and erection for all forms of construction in building and civil engineering. Associate Members are those principal companies involved in the purchase, design or supply of components, materials, services etc, related to the industry. Corporate Members are clients, professional offices, educational establishments etc, which support the development of national specifications, health and safety, quality, fabrication and erection techniques, overall industry efficiency and good practice. The principal objectives of the association are to promote the use of structural steelwork; to assist specifiers and clients; to ensure that the capabilities and activities of the industry are widely understood; and to provide members with professional services in technical, commercial and quality assurance matters.

Details of BCSA Membership and services are available from: Gillian Mitchell MBE, Deputy Director General, British Constructural Steelwork Association Ltd, 4 Whitehall Court, Westminster, London SW1A 2ES. **Tel** 020 7839 8566 **Fax** 020 7976 1634

KEY

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

Quality Assurance Certification
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- **Q2** BSI
- **Q3** Lloyd's
- **Q4** Other

Classification Contract Value
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- **8** Up to £200,000
- **7** Up to £400,000
- **6** Up to £800,000
- **5** Up to £1,400,000
- **4** Up to £2,000,000
- **3** Up to £3,000,000
- **2** Up to £4,000,000
- **1** Up to £6,000,000
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Notes
1. Applicants may be registered in one or more categories to undertake the fabrication and the responsibility for any design and erection of the above.
2. Where an asterisk (*) appears against any company's classification number, this indicates that the assets required for this classification are those of the parent company.

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

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Tarron Road, Tarron Industrial Estate, Moreton, Wirral CH46 4TU
Tel 0151 678 0236 **Fax** 0151 678 8959

SEVERFIELD-REEVE STRUCTURES LTD (A 0* Q2)
Dalton Airfield Industrial Estate, Dalton, Thirsk, North Yorkshire YO7 3JN
Tel 01845 577896 **Fax** 01845 577411

SHIPLEY FABRICATIONS LTD
Maddocks Park, Ancaster, Grantham, Lincs NG32 3PL
Tel 01400 231115 **Fax** 01400 231220

SNASHALL STEEL FABRICATIONS CO LTD
Pulham Business Park, Pulham, nr Dorchester, Dorset DT2 7DX
Tel 01300 345588 **Fax** 01300 345533

SOUTH DURHAM STRUCTURES LTD
South Church Enterprise Pk, Dovecot Hill, Bishop Auckland, Co. Durham DL14 6XR
Tel 01388 777350 **Fax** 01388 775225

TAYLOR & RUSSELL LTD
Stonebridge Mill, Longridge PR3 3AQ
Tel 01772 782295 **Fax** 01772 785341

THE AA GROUP LTD
Priorswood Place, East Pimbo, Skelmersdale, Lancs WN8 9QB
Tel 01695 50123 **Fax** 01695 50133

THE STEEL PEOPLE LTD
Unit 3E, Priory Park, Mills Road, Aylesford, Kent ME20 7PP
Tel 01622 715900 **Fax** 01622 715905

TRADITIONAL STRUCTURES LTD (D E F H J K M N 5 Q1)
Findel Works, Landywood Lane, Cheslyn Hay, Walsall, West Midlands WS6 7AJ
Tel 01922 414172 **Fax** 01922 410211

WARLEY CONSTRUCTION COMPANY LTD (F L 7)
Swinborne Road, Burnt Mills Industrial Estate, Basildon, Essex SS13 1LD
Tel 01268 726060 **Fax** 01268 725285

WALTER WATSON LTD (Q4)
Greenfield Works, Ballylough Rd, Castlewellan, Co Down BT31 9JQ
Tel 028 4377 8711 **Fax** 028 4377 2050

WATSON STEEL STRUCTURES LTD (A B 0* Q1)
PO Box 9, Lostock Lane, Bolton BL6 4TB
Tel 01204 699999 **Fax** 01204 694543

WESTBURY PARK ENGINEERING LTD
Brook Lane, Westbury, Wilts BA13 4ES
Tel 01373 825500 **Fax** 01373 825511

WESTOK LTD (Q2)
Horbury Junction Ind Est, Horbury Junction, Wakefield WF4 5ER
Tel 01924 264121 **Fax** 01924 280030

JOHN WICKS & SON LTD
Unit 1, Crabbers Cross, Rattery, South Brent, Devon TQ10 9JZ
Tel 01364 72907 **Fax** 01364 73054

WIG ENGINEERING LTD
Barnfield, Akeman Street, Chesterton, Oxon OX26 1TE
Tel 01869 320515 **Fax** 01869 320513

H. YOUNG STRUCTURES LTD (C E F H J N 6)
Ayton Road, Wymondham, Norfolk NR18 0RD
Tel 01953 601881 **Fax** 01953 607842

ASSOCIATE MEMBERS

STRUCTURAL COMPONENTS

ALBION SECTIONS LTD (Q4)
Albion Rd, West Bromwich, West Midlands B70 8BD
Tel 0121 553 1877 **Fax** 0121 553 5507

AYRSHIRE METAL PRODUCTS (DAVENTRY) LTD (Q1)
Royal Oak Way, Daventry NN11 5NR
Tel 01327 300990 **Fax** 01327 300885

BARNSHAW PLATE BENDING CENTRE LTD
Corporation Rd, Audenshaw, Manchester M34 5LR
Tel 0161 320 9696 **Fax** 0161 335 0918

CELLBEAM LTD
Unit 516, Thorp Arch Estate, Wetherby, West Yorkshire LS23 7DB
Tel 01937 840614 **Fax** 01937 840608

COMPOSITE PROFILES UK LTD
15 Moor Road, Broadstone, Dorset BH18 8AZ
Tel 01202 659237 **Fax** 01202 659288

CORUS PANELS & PROFILES (Q1)
Severn Drive, Tewkesbury Business Park, Tewksbury, Glos GL20 8TX
Tel 01684 856600 **Fax** 01684 856601

FLI PRODUCTS
Waterwells Drive, Waterwells Business Park, Gloucester GL2 2AA
Tel 01242 722200 **Fax** 01242 722244

FABSEC LTD
Brooklands Court, Tunstall Road, Leeds LS11 5HL
Tel 0113 385 7830 **Fax** 0113 272 7587

HI–SPAN LTD
Ayton Rd, Wymondham NR18 0RD
Tel 01953 603081 **Fax** 01953 607842

INTELLIGENT ENGINEERING (UK) LTD
Shire House, West Common, Gerrards Cross, Bucks SL9 7QN
Tel 01753 890575 **Fax** 01753 899056

KINGSPAN METL-CON LTD (Q4)
Sherburn, Malton, N. Yorkshire YO17 8PQ
Tel 01944 712000 **Fax** 01944 710555

RICHARD LEES STEEL DECKING LTD
Moor Farm Rd West, The Airfield, Ashbourne, Derbyshire DE6 1HD
Tel 01335 300999 **Fax** 01335 300888

MSW STRUCTURAL FLOOR SYSTEMS
Acton Grove, Long Eaton, Nottingham NG10 1FY
Tel 0115 946 2316 **Fax** 0115 946 2278

METSEC PLC (Q2)
Broadwell Rd, Oldbury, West Mids B69 4HE
Tel 0121 601 6000 **Fax** 0121 601 6181

STRUCTURAL METAL DECKS LTD
The Outlook, Ling Road, Tower Park, Poole, Dorset BH12 4PY
Tel 01202 718898 **Fax** 01202 714980

STRUCTURAL SECTIONS LTD (Q1)
PO Box 92, Downing St, Smethwick, Warley B66 2PA
Tel 0121 555 1342 **Fax** 0121 555 1341

STUDWELDERS LTD
Millennium Hse, Severn Link Distribution Centre, Newhouse Farm Ind Est, Chepstow, Monmouthshire NP16 6UN
Tel 01291 626048 **Fax** 01291 629979

COMPUTER SOFTWARE

COMPUTER SERVICES CONSULTANTS (UK) LTD
Yeadon House, New St, Pudsey, Leeds, LS28 8AQ
Tel 0113 239 3000 **Fax** 0113 236 0546

PSYCLE INTERACTIVE LTD
The Stable House, Whitewell, Whitchurch, Shropshire SY13 3AQ
Tel 01948 780120 **Fax** 08701 640156

RAM INTERNATIONAL (EUROPE) LTD
4 Woodside Place, Glasgow G3 7QF
Tel 0141 353 5168 **Fax** 0141 353 5112

STEEL PROJECTS UK LTD
Lupton Court, Prospect Court, Ossett, Wakefield WF5 8AF
Tel 01924 282008 **Fax** 01924 282007

TEKLA (UK) LTD
Tekla House, Cliffe Park Way, Morley, Leeds LS27 0RY
Tel 0113 307 1200 **Fax** 0113 307 1201

DESIGN SERVICES

ARRO-CAD LTD
Bretby Business Park, Ashby Road, Bretby, Burton-on-Trent DE15 0YZ
Tel 01283 558206 **Fax** 01283 558207

CALEDONIA DRAUGHTING LTD
36 Maple Road, Perth PH1 1EZ
Tel 01738 560501 **Fax** 01738 560501

DEVELOPMENT DESIGN DETAILING SERVICES LTD
171 Bradshawgate, Bolton, Lancs BL2 1BH
Tel 01204 396606 **Fax** 01204 396634

ODDA DESIGN LTD
The White House, Clifton Marine Parade, Imperial Business Park, Gravesend, Kent DA11 0DY
Tel 01474 352849 **Fax** 01474 359116

STEEL PRODUCERS

CORUS CONSTRUCTION & INDUSTRIAL
Frodingham House, PO Box 1, Brigg Road, Scunthorpe DN16 1BP
Tel 01724 404040 **Fax** 01724 404229

CORUS TUBES
PO Box 101, Weldon Rd, Corby, Northants NN17 5UA
Tel 01536 402121

MANUFACTURING EQUIPMENT

FICEP (UK) LTD
10 The Courtyards, Victoria Park, Victoria Road, Leeds LS14 2LB
Tel 0113 265 3921 **Fax** 0113 265 3913

KALTENBACH LTD
6-8 Brunel Road, Bedford MK41 9TJ
Tel 01234 213201 **Fax** 01234 351226

PEDDINGHAUS CORPORATION UK LTD
Unit 6, Queensway Link, Stafford Park 17, Telford TF3 3DN
Tel 01952 200377 **Fax** 01952 292877

RÖSLER UK
Unity Grove, Knowsley Business Park, Prescot, Merseyside L34 9GT
Tel 0151 482 0444 **Fax** 0151 482 4444

VOORTMAN UK LTD
Unit 8, Mercian Park, Felspar Rd, Amington Rd, Tamworth B77 4DP
Tel 01827 63300 **Fax** 01827 65565

PROTECTIVE SYSTEMS

AMERON INTERNATIONAL
Blackwell Road, Huthwaite, Sutton in Ashfield, Notts NG17 2RL
Tel 01623 511000 **Fax** 01623 559616

FORWARD PROTECTIVE COATINGS LTD
Vernon St., Shirebrook, Mansfield, Notts NG20 8SS
Tel 01623 748323 **Fax** 01623 748730

INTERNATIONAL PAINT LTD
Protective Coatings, Stoneygate Lane, Felling, Gateshead NE10 0JY
Tel 0191 469 6111 **Fax** 0191 495 0676

LEIGH'S PAINTS
Tower Works, Kestor Street, Bolton BL2 2AL
Tel 01204 521771 **Fax** 01204 382115

SIGMA COATINGS LTD
4 Vimy Court, Vimy Road, Leighton Buzzard LU7 1FG
Tel 01525 375234 **Fax** 01525 378595

SITE COAT SERVICES LTD
Unit 11, Old Wharf Road, Grantham, Lincolnshire NG31 7AA
Tel 01476 577473 **Fax** 01476 577642

JACK TIGHE LTD
Kirk Sandall Ind. Est., Kirk Sandall, Doncaster DN3 1QR
Tel 01302 880360 **Fax** 01302 880370

WEDGE GROUP GALVANIZING
c/o Worksop Galvanizing Claylands Avenue,Worksop, Notts S81 7BQ
Tel 01909 486384 **Fax** 01909 482540

SAFETY SYSTEMS

COMBISAFE INTERNATIONAL LTD
Unit 1, Zone A, Cheaney Drive, Grange Park, Northampton NN4 5FB
Tel 01604 660600 **Fax** 01604 662960

EASI-EDGE
Ollerton Rd, Tuxford, Newark, Notts NG22 0PQ
Tel 01777 870901 **Fax** 01777 870524

STEEL STOCKHOLDERS

ADVANCED STEEL SERVICES LTD
South Ribble Industrial Estate, Capitol Way, Preston, Lancs PR5 4AJ
Tel 01772 259822 **Fax** 01772 259561

ALTERNATIVE STEEL CO LTD
Dobson Park Way, Ince, Wigan WN2 2DY
Tel 01942 610601 **Fax** 01942 821999

ASD METAL SERVICES – EDINBURGH
24 South Gyle Crescent, Edinburgh EH12 9EB
Tel 0131 459 3200 **Fax** 0131 459 3266

ASD METAL SERVICES – BODMIN
Unit 13, Cooksland Ind. Est., Bodmin, Cornwall PL31 2PZ
Tel 01208 77066 **Fax** 01208 77416

ASD METAL SERVICES – LONDON
Thames Wharf, Dock Road, London E16 1AF
Tel 020 7476 9444 **Fax** 020 7476 0239

ASD METAL SERVICES – CARLISLE
Unit C, Earls Way, Kingsmoor Park Central, Kingstown, Cumbria CA6 4SE
Tel 01228 674766 **Fax** 01228 674197

ASD METAL SERVICES – HULL
Gibson Lane, Melton, North Ferriby, East Riding of Yorkshire HU14 3HX
Tel 01482 633360 **Fax** 01482 633370

ASD METAL SERVICES – GRIMSBY
Estate Road No. 5, South Humberside Industrial Estate, Grimsby DN31 2TX
Tel 01472 353851 **Fax** 01472 240028

ASD METAL SERVICES – BIDDULPH
PO Box 2, Tunstall Road, Biddulph, Stoke-on-Trent, Staffs ST8 6JZ
Tel 01782 515152 **Fax** 01782 522240

ASD METAL SERVICES – DURHAM
Drum Road, Drum Industrial Estate, Chester-le-Street, Co. Durham DH2 1ST
Tel 0191 492 2322 **Fax** 0191 410 0126

ASD METAL SERVICES – CARDIFF
East Moors Road, Cardiff CF1 5SP
Tel 029 2046 0622 **Fax** 029 2049 0105

ASD METAL SERVICES – STALBRIDGE
Station Rd, Stalbridge, Dorset DT10 2RW
Tel 01963 362646 **Fax** 01963 363260

ASD METAL SERVICES – NORFOLK
Hamlin Way, Kings Lynn, Norfolk PE30 4LQ
Tel 01553 761431 **Fax** 01553 692394

ASD METAL SERVICES – EXETER
Sidmouth Road, Clyst St Mary, Exeter EX5 1AD
Tel 01395 233366 **Fax** 01395 233367

ASD METAL SERVICES – DAVENTRY
Royal Oak Ind. Est., Daventry, Northants NN11 5QQ
Tel 01327 876021 **Fax** 01327 87612

ASD METAL SERVICES – TIVIDALE
Tipton Road, Tividale, Oldbury, West Midlands B69 3HU
Tel 0121 520 1231 **Fax** 0121 520 5664

AUSTIN TRUMANNS STEEL LTD
Moss Lane, Walkden, Manchester M28 5NH
Tel 0161 790 4821 **Fax** 0161 799 0411

BARRETT STEEL SERVICES LTD
Barrett House, Cutler Heights Lane, Dudley Hill, Bradford BD4 9HU
Tel 01274 682281 **Fax** 01274 651205

BROWN MCFARLANE LTD
Ladywell Works, New Century Street, Hanley, Stoke-on-Trent ST1 5QH
Tel 01782 289909 **Fax** 01782 289804

BRUNSWICK STEEL SERVICES
South Park Road, South Park Industrial Estate, Scunthorpe DN17 2BY
Tel 01724 810811 **Fax** 01724 819981

CELTIC STEEL SERVICES
Caerphilly Road, Ystrad Mynach, Mid Glamorgan CF82 6EP
Tel 01443 812181 **Fax** 01443 812558

CORUS SERVICE CENTRE
Farnigham Road Station, South Darenth, nr Dartford DA4 9LD
Tel 01322 227272 **Fax** 01322 864893

CORUS SERVICE CENTRE
Badminton Rd Trading Est., Yate, Bristol BS37 5JU
Tel 01454 315314 **Fax** 01454 325181

CORUS SERVICE CENTRE
Spittlegate Industrial Estate, Grantham, Lincolnshire NG31 7UP
Tel 01476 565522 **Fax** 01476 562459

CORUS SERVICE CENTRE
Blackamore Road, Walker Industrial Estate, Guide, Blackburn BB1 2LJ
Tel 01254 55161 **Fax** 01254 670836

CORUS SERVICE CENTRE
South Street, Glasgow G14 0BX
Tel 0141 959 1212 **Fax** 0141 959 0111

CORUS SERVICE CENTRE
Moira Rd, Lisburn, Co. Antrim BT28 2SN
Tel 01846 660747 **Fax** 01846 660748

CORUS SERVICE CENTRE
Wakefield Rd, Stourton, Leeds LS10 1AY
Tel 0113 276 0660 **Fax** 0113 272 4418

CORUS SERVICE CENTRE
The Steelpark, Steelpark Way, Wednesfield, Wolverhampton WV11 3BR
Tel 01902 484000 **Fax** 01902 484041

DUDLEY IRON & STEEL CO LTD
Unit 8, Autobase Industrial Estate, Tipton Road, Tividale, West Midlands B69 3HU
Tel 0121 601 5000 **Fax** 0121 601 5001

NATIONAL TUBE STOCKHOLDERS LTD
Dalton Industrial Estate, Dalton, Thirsk, North Yorkshire YO7 3HE
Tel 01845 577440 **Fax** 01845 577165

NEWTON STEEL STOCK LTD
Landshire Lane, Gibbs Marsh Trading Estate, Henstridge, Somerset BA8 0TN
Tel 01963 365028 **Fax** 01963 365034

PORTWAY STEEL SERVICES
The Stables, Brook Farm, Westerleigh, Bristol BS37 8QH
Tel 01454 311442 **Fax** 01454 311445

RAINHAM STEEL CO LTD
Kathryn House, Manor Way, Rainham, Essex RM13 8RE
Tel 01708 522311 **Fax** 01708 559024

SOUTH PARK STEEL SERVICES
Warrington Business Park, Long Lane, Warrington, Cheshire WA2 8TX
Tel 01925 245511 **Fax** 01925 245566

SOUTH PARK STEEL SERVICES
South Park Road, South Park Industrial Estate, Scunthorpe DN17 2BY
Tel 01724 810810 **Fax** 01724 810081

STEELSTOCK (BURTON ON TRENT) LTD
Ryder Close, Cadley Hill Road, Swadlincote, Derbyshire DE11 9EU
Tel 01283 226161 **Fax** 01283 550406

STRUTHERS & CARTER LTD
Erimus Works, Valletta Street, Hedon Road, Hull HU9 5NU
Tel 01482 795171 **Fax** 01482 786186

STRUCTURAL FASTENERS

THOMAS WILLIAM LENCH LTD
P O Box 31, Excelsior Works, Carnegie Road, Rowley Regis, West Mids B65 8BZ
Tel 0121 559 1530 **Fax** 0121 559 3920

CORPORATE MEMBERS

BALFOUR BEATTY POWER NETWORKS LTD
Tel 01332 661491

GRIFFITHS & ARMOUR
Tel 0151 236 5656

HIGHWAYS AGENCY
Tel 08457 504030

ROGER POPE ASSOCIATES
Tel 01752 263636

The Register of Qualified Steelwork Contractors

BUILDINGS SCHEME

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

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

Company Name	Telephone	A	C	D	E	F	H	J	K	L	M	N	S	QA	Contract Value (1)
ACL Structures Ltd	01258 456051				●	●	●				●				Up to £2,000,000
Atlas Ward Structures Ltd	01944 710421	●	●	●	●	●	●	●	●	●	●			●	Up to £6,000,000*
B D Structures Ltd	01942 817770			●	●	●	●								Up to £1,400,000*
B & K Steelwork Fabrications Ltd	01773 853400		●		●	●	●	●	●		●			●	Up to £4,000,000*
A C Bacon Engineering Ltd	01953 850611				●	●	●								Up to £800,000
Ballykine Structural Engineers Ltd	028 9756 2560				●	●	●	●				●		●	Up to £2,000,000
Barrett Steel Buildings Ltd	01274 266800				●	●	●							●	Up to £6,000,000
Billington Structures Ltd	01226 340666	●	●	●	●	●	●	●	●	●	●	●		●	Up to £6,000,000
Bison Structures Ltd	01666 502792			●	●	●	●							●	Up to £2,000,000
Border Steelwork Structures Ltd	01228 548744		●		●	●	●					●			Up to £1,400,000
Bourne Steel Ltd	01202 746666	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901		●			●	●	●	●	●	●			●	Up to £800,000
Brooksby Engineering	01707 872655					●		●	●	●	●				Up to £200,000
CTS Ltd	01484 606416						●	●							Up to £800,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000*
Compass Engineering Ltd	01226 298388		●		●	●	●		●						Up to £2,000,000
Leonard Cooper Ltd	0113 270 5441		●			●	●		●		●			●	Up to £800,000
Costruzioni Cimolai Armando SpA	01223 350876	●	●	●	●	●	●	●	●	●	●	●		●	Up to £6,000,000
Curtis Engineering Ltd	01373 462126					●									Up to £800,000
Frank H Dale Ltd	01568 612212			●	●	●								●	Up to £4,000,000
EAGLE Structural Ltd	01507 450081				●	●	●	●	●	●					Up to £400,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●		●			●		●	Up to £4,000,000
Emmett Fabrications Ltd	01274 597484				●	●	●								Up to £800,000
EvadX Ltd	01745 336413				●	●	●	●		●	●	●		●	Up to £1,400,000
Fairfield-Mabey Ltd	01291 623801	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000*
Fisher Engineering Ltd	028 6638 8521	●	●	●	●	●	●	●	●	●	●	●		●	Up to £6,000,000
Glentworth Fabrications Ltd	0118 977 2088					●	●	●	●	●	●	●		●	Up to £2,000,000
Graham Wood Structural Ltd	01903 755991	●	●	●	●	●	●	●	●	●	●	●			Up to £2,000,000
D A Green & Sons Ltd	01406 370585				●	●	●	●				●		●	Up to £3,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456		●		●	●	●	●	●	●	●			●	Up to £6,000,000
James Bros (Hamworthy) Ltd	01202 673815				●	●	●	●				●		●	Up to £2,000,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●					●			Up to £6,000,000*
Meldan Fabrications Ltd	01652 632075		●		●	●	●	●	●		●			●	Up to £4,000,000
Mifflin Construction Ltd	01568 613311			●	●	●	●				●				Up to £2,000,000
Harold Newsome Ltd	0113 257 0156				●	●	●								Up to £1,400,000
Normanby Wefco Ltd	01427 611000		●				●	●	●		●			●	Up to £800,000
Oswestry Industrial Buildings Ltd	01691 661596				●	●	●		●		●				Up to £400,000
RSL (South West) Ltd	01460 67373				●	●	●				●				Up to £800,000
John Reid & Sons (Strucsteel) Ltd	01202 483333	●	●	●	●	●	●	●	●	●	●	●			Up to £6,000,000
J Robertson & Co Ltd	01255 672855									●	●		●		Up to £100,000
Robinson Construction	01332 574711		●	●	●	●	●							●	Up to £6,000,000
Roll Formed Fabrications Ltd	028 7963 1631				●	●	●	●		●	●	●		●	Up to £800,000
Rowecord Engineering Ltd	01633 250511	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000
Rowen Structures Ltd	01623 558558	●	●	●	●	●	●	●	●	●	●	●			Up to £6,000,000
SIAC Butlers Steel Ltd	00 353 502 23305		●	●	●	●	●	●				●		●	Up to £6,000,000
Severfield-Reeve Structures Ltd	01845 577896	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000*
Henry Smith (Constructional Engineers) Ltd	01606 592121		●	●	●	●	●	●							Up to £2,000,000
Traditional Structures Ltd	01922 414172			●	●	●	●	●	●		●	●		●	Up to £1,400,000
Warley Construction Company Ltd	01268 726020				●					●					Up to £400,000
Watson Steel Structures Ltd	01204 699999	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000*
Webcox Engineering Ltd	01249 813225				●	●	●				●				Up to £400,000
H Young Structures Ltd	01953 601881		●		●	●	●	●				●			Up to £800,000

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

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

RQSC
The Register of Qualified Steelwork Contractors Scheme

BRIDGEWORKS SCHEME

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

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

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

Company Name	Telephone	FG	PT	BA	CM	MB	RF	X	Contract Value (1)
Allerton Engineering Ltd	01609 774471	●	●	●	●	●	●		Up to £1,400,000*
Briton Fabricators Ltd	0115 963 2901	●	●	●			●		Up to £800,000
Butterley Ltd	01773 573573	●	●	●	●	●	●		Up to £3,000,000*
CTS Ltd	01484 606416	●	●		●	●			Up to £800,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●		Above £6,000,000*
Costruzioni Cimolai Armando SpA	01223 350876	●	●	●	●	●			Up to £6,000,000
Fairfield-Mabey Ltd	01291 623801	●	●	●	●	●	●		Above £6,000,000*
Harland & Wolff Heavy Industries Ltd	028 9045 8456	●	●	●	●		●		Up to £6,000,000
Interserve Project Services Ltd	0121 344 4888						●		Above £6,000,000
Interserve Project Services Ltd	020 8311 5500		●	●		●	●		Up to £400,000*
Mandall Engineering Ltd	0114 243 0001	●	●	●	●	●	●		Up to £800,000*
Meldan Fabrications Ltd	01652 632075	●	●	●	●	●	●		Up to £4,000,000
'N' Class Fabrication Ltd	01733 558989	●	●	●		●	●		Up to £1,400,000
Normanby Wefco Ltd	01427 611000	●	●	●			●		Up to £800,000
Nusteel Structures Ltd	01303 268112	●	●	●	●				Up to £2,000,000*
P C Richardson & Co (Middlesbrough) Ltd	01946 727119	●					●		Up to £6,000,000
Rowecord Engineering Ltd	01633 250511	●	●	●	●	●	●		Above £6,000,000
Taylor & Sons Ltd	029 2034 4556	●	●	●	●	●	●		Up to £800,000
Watson Steel Structures Ltd	01204 699999	●	●	●	●	●	●		Above £6,000,000*

Notes (') Contracts which are primarily steel but which may include associated works. The steelwork contract for which a company is pre-qualified for the Scheme is intended to give guidance on the size of steelwork contract that can be undertaken; where a project lasts longer than a year, the value is the proportion of the steelwork contract to be undertaken within a 12 month period.
(*) Where an asterisk appears against any company's classification number, this indicates that the assets required for this classification level are those of the parent company.

SCI Members

The Steel Construction Institute

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

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

Details of SCI Membership and services are available from:
Pat Ripley, Membership Manager, The Steel Construction Institute, Silwood Park, Ascot, Berks.
Telephone: +44 (0)1344 623345 Fax: +44 (0)1344 622944
Email: pat.ripley@steel-sci.com Website: www.steel-sci.com

The Steel Construction Institute Institute would like to welcome the following new Corporate Members:

UK
Abraham Consulting Engineers
AWE

All full members of the BCSA are automatically members of the SCI. Their contact details are listed on the BCSA Members pages