NOVEMBER/DECEMBER 2006 VOL 14 NO 10

NSC

NEW STEEL CONSTRUCTION

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Below ground at Heathrow T5
Large spans speed up Leeds dock project
New style for listed Glasgow facade
Thermal bridging and Part L

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Client: Westfield shoppingtowns
Architect: WDE
Structural Engineer: MPN
Steelwork Contractor: Rowen Structures

EDITOR
Nick Barrett Tel: 01323 422483
nick@new-steel-construction.com
DEPUTY EDITOR
Martin Cooper Tel: 01892 538191
martin@new-steel-construction.com
CONTRIBUTING EDITOR
Ty Byrd Tel: 01892 524455
ty@barrett-byrd.com
PRODUCTION EDITOR
Andrew Pilcher Tel: 01892 524481
andrew@new-steel-construction.com
ISDN: 01892 557302
NEWS REPORTERS
Mike Walter, Victoria Millins
ADVERTISING SALES MANAGER
Sally Devine Tel: 01474 833871
sally@new-steel-construction.com

PUBLISHED BY
The British Constructional Steelwork Association Ltd
4 Whitehall Court, Westminster, London SW1A 2ES
Telephone 020 7839 8566 **Fax** 020 7976 1634
Website www.steelconstruction.org
Email postroom@steelconstruction.org

The Steel Construction Institute
Silwood Park, Ascot, Berkshire SL5 7QN
Telephone 01344 636525 **Fax** 01344 636570
Website www.steel-sci.org
Email reception@steel-sci.org

Corus Construction and Industrial
PO Box 1, Brigg Road, Scunthorpe, North Lincolnshire DN16 1BP
Telephone 01724 404040 **Fax** 01724 404224
Website www.corusconstruction.com
Email tsm@corusgroup.com

CONTRACT PUBLISHER & ADVERTISING SALES
Barrett, Byrd Associates
Linden House, Linden Close,
Tunbridge Wells, Kent TN4 8HH
Tel: 01892 524455
www.barrett-byrd.com

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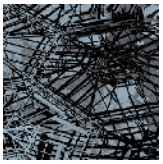

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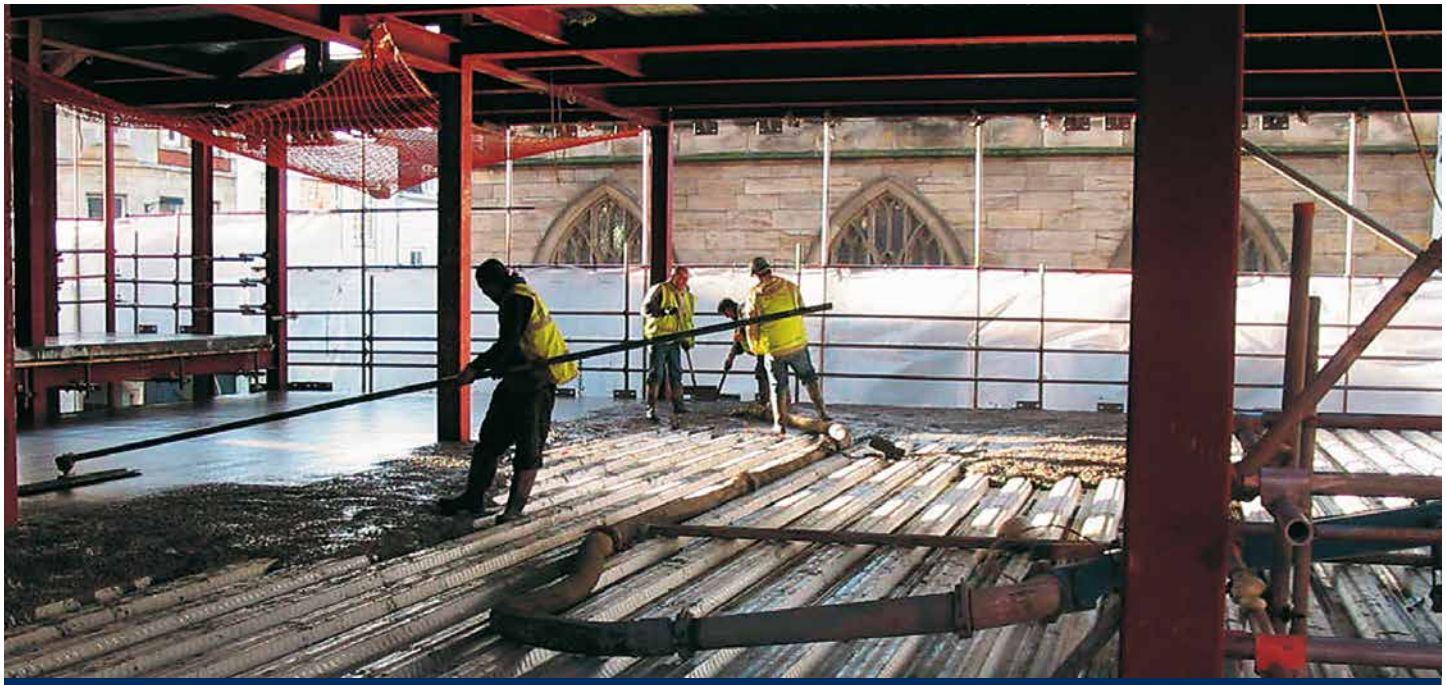

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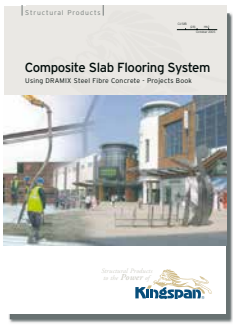

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Steel frames' cost bears no comparison

Nick Barrett - Editor

Away from the headlines about steel industry takeovers and mergers and worldwide rising prices for energy, the UK's structural steelwork success story quietly trundles on. The latest evidence that the marketplace continues to decide in favour of steel comes from this year's Cost Comparison study from Davis Langdon (see news).

Every year since 1993 this study has been carried out, comparing the cost of using steel and concrete as framing material for two typical commercial developments and every year steel has consistently been proven to be the most cost effective framing solution. Steel wins out on purely cost grounds even before the benefits like faster construction times – essential to many developers – are factored in. Several years ago Corus came up with the name the Competitive Gap to describe the gap between steel and concrete prices; the gap shows no signs of narrowing.

In real terms steel is actually cheaper than it was 20 years ago, as massive productivity gains have been shared with clients. Competition helps keep prices keen among steelwork contractors, with clients able to attract a healthily long tender list when they go to the market for prices. If using other framing materials there might only be two or at best three tenders.

Early indications from gathering market share statistics suggest that steel is maintaining its performance in key market sectors, and improving in some. Market share can be expected to grow in areas like healthcare now that the old sore of steel sections having to be made uneconomically heavy to resist floor vibration have been laid to rest by the Steel Construction Institute. SCI's research has rebuked suggestions made by rivals that steel – concrete composite floors would have to be uneconomically deep to attain the required vibration performance.

Composite floors meet the National Health Service requirements easily, with a large margin to spare. It is being said that the initial vibration performance of concrete is not always borne out over time, as concrete creep has an adverse impact on performance. Unlike its rivals, steel is in rude good health.

Charter proves sustainability credentials

The BCSA's Steel Construction Sustainability Charter is now a year old, and already it is apparent that this is a project that is destined to succeed. The first of the initial signatories to the charter have passed through their sustainability audits with flying colours and more companies are realising the benefits and signing up.

The call from the client side for construction to adopt sustainable practices has also grown over the past year, with this year's soaring energy prices adding economics to the arguments in favour of pursuing sustainability through lowering energy consumption. A year ago we warned that fresh impetus to the drive for sustainable buildings would come from London's hosting of the 2012 Olympics, as government and the delivery authorities saw the games as an opportunity to drive sustainability forward. Things have not happened fast enough at the Olympics to suit all observers, but progress is being made and the need for sustainable approaches can be expected to be stressed again soon.

Work done by the steel sector over many years means that the industry is in the fortunate position of being able to prove its sustainability credentials. Contractors who want to be able to do the same could do no better than sign up to the Sustainability Charter as the help they can then be given will ensure that they are not only working with a sustainable material and with due respect to the environment, but they will be able to prove that they do so.

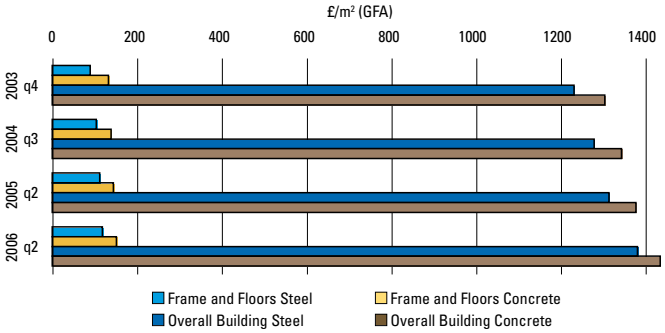
Competitive gap still favours steel

Structural steel remains the most cost effective option for building frames and floors in the latest update of a building cost comparison study carried out by cost consultants Davis Langdon.

The cost of structural steelwork and alternative framing materials – particularly concrete – have all risen since the previous study a year ago, but the competitive advantage of steel has been maintained, according to the Davis Langdon findings. The study is the latest in a series commissioned by Corus that goes back to 1993, comparing the relative costs of constructing two fully specified commercial buildings, a speculative office development in Manchester and a London head office development.

'These figures update the survey of a year ago with prices to the second quarter of 2006, and show that steel is still the choice to make even when purely cost grounds are considered,' says Corus General Manager Alan Todd. 'When you add to the cost benefits all the other arguments for steel like speed, flexibility and sustainability, then it is no surprise that steel continues to capture market share.

'There has been no change in the relative competitive position of steel in comparison with other framing and flooring materials over the past few years, as this series of surveys shows.'



The overall cost advantage from using steel is estimated at in excess of £50 per m², without allowing for the faster construction times afforded by steel.

(A fuller report of the study will be carried in the January 2007 edition of NSC)

Work begins on Freedom Tower

Picture: Skidmore, Owings and Merrill

Work has started on the foundations for the world's tallest building, the Freedom Tower, which will occupy the northwest corner of the 16-acre World Trade Centre site in New York.

Topping out at a height of 1,776ft the steel framed structure will include an 80ft high public lobby within a 200ft high base and then 69 floors of office space, restaurants and parking.

Freedom Tower will culminate in a glass parapet that marks the respective heights (1,362ft and 1,368ft) of the original World Trade Centre towers, while on top of this an antenna reaches the final topping out height.

Structural engineers for the project, Cantor Seinuk, and architects Skidmore, Owings and Merrill, said the Tower will have a robust steel frame consisting of beams and columns connected by a combination of welding and bolting.

The companies added that, paired with a concrete core shear wall, the frame lends substantial rigidity to the overall structure while providing column-free interior spans.

The construction schedule envisages steelwork being visible above the base in 2008 with topping out in 2010 and full occupancy in 2011.

Steel takes the RIBA prizes

Three of the six shortlisted projects for the prestigious 2006 RIBA Stirling Prize were steel structures, including the overall winner.

Picking up the £20,000 annual Stirling Prize was the New Area Terminal (right) at Madrid's Barajas Airport designed by Richard Rogers Partnership.

The judges commented the roof is impressive from inside the six floor building, while its dramatic wave shapes which are supported by a gymnastic steel structure, allows daylight in via huge roof lights.

A 'tour de force' which is also 'remarkably soothing' according to one judge, the terminal is making Madrid a southern European hub to rival Heathrow.

The other two steel projects to be shortlisted were the Evelina Children's Hospital in London (below) and the National Assembly for Wales (NAW) in Cardiff.

These two structures were first and second respectively, in the People's Award, which is voted for by the public.

"Evelina Hospital is one of a number of exciting projects we have done over the years with Hopkins Architects and we are delighted at the success," said Tim Burton, Sales and Marketing Manager for SH Structures, which was also the steelwork contractor for NAW.

"The architect has clearly produced a scheme that will hopefully set the standard for the design of other hospitals and public buildings in the future," Mr Burton added.

Picture: Richard Rogers Partnership

Contractors sign up to sustainability charter

Sustainability is rapidly moving up the agenda as a procurement issue and increasingly construction clients are looking for companies which operate in a 'sustainable' manner.

Steel is being promoted as a more sustainable form of construction because it is recyclable, fabricated off-site and safer to erect.

In order to complement this, the Steel Construction Sustainability Charter was launched which requires firms signing up to it to complete a Sustainability Application Form. They must also undergo a new sustainability audit and score a minimum of six points from a possible 12.

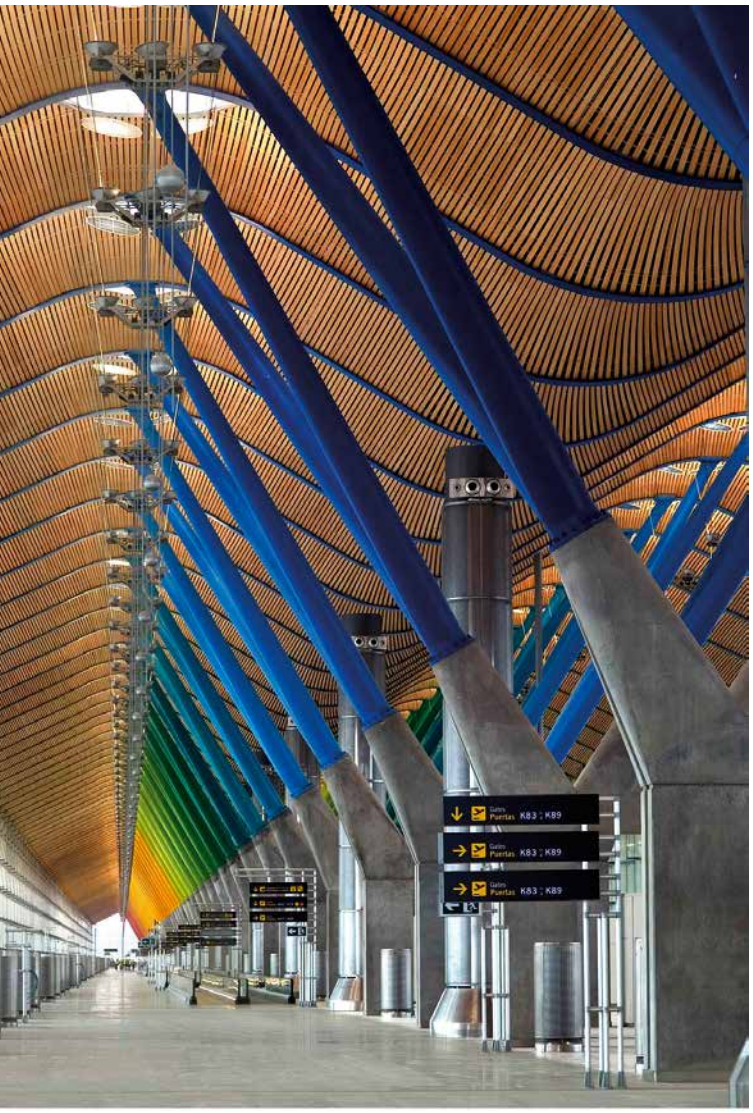
Companies are then awarded Charter Status in three levels: Member for six, seven or eight points; Silver for nine, 10 or 11 points, and Gold for 12 points.

Currently nine contractors have been successfully audited. ACL Structures, Fisher Engineering and Graham Wood Structural have member status. Cairnhill Structures, Elland Steel Structures, Fairfield-Mabey and Rowecord Engineering have silver status. While gold status has been awarded to Barrett Steel Buildings and Billington Structures.

The BCSA said the objective of the Charter is to develop steel as a sustainable form of construction in terms of economic viability, social progress and environmental responsibility.

To fulfill this, Charter members are required to make a formal declaration which includes: Operating in an efficient and financially sustainable way; optimising the impact of manufacturing and construction activities; foster the health and safety of employees, and build on their knowledge of sustainability by helping steel and construction companies in the supply chain to implement sustainable policies.

Sustainability in Steel Construction



Portal frames at Project Orange

Atlas Ward Structures has completed the steelwork for two large warehouses, as well as an adjacent ancillary structure, known as the Iced Water Building, for the Gerber Juice Company.

Known as 'Project Orange', the developments are situated on the Express Park in Bridgewater, Somerset and the contracts were awarded by main contractor Pearce Group.

Gerber has been manufacturing soft drinks and food at various facilities in the Bridgewater area since 1896, and is planning to unite all distribution and production at this new site.

In total Atlas Ward has designed, fabricated and erected more than 2,500t of hot and cold rolled steelwork and decking.

Phase One of the project was erected last year and consisted of a manufacturing and distribution warehouse with a footprint of 25,000m^2. Phase Two was built earlier this year and is a 15,500m^2 extension to the initial structure.

Bill Armstrong, Atlas Ward's Project Manager, said both buildings are portal frame structures consisting of three 30m spans, one 15m span and a 7.5m wide service corridor.

Gerber said it needs a new and larger facility to meet anticipated growth in the UK soft drinks market.

AROUND THE PRESS

The Times
27 September 2006
Gaining market share
"Commercial development activity is helping Severfield of course, but considerable extra spice is added to the investment story because steel frames are replacing concrete in construction projects. Steel is quicker and easier to manoeuvre. It also gives architects more design flexibility."

Construction News
12 October 2006
Manufacturer launches 21 universal beam options and Advance brand
Steel maker Corus is extending the number of section sizes it produces in what is set to be the biggest shake-up in structural steel manufacturing for half a century. Structural engineers and designers will now be able to choose from 21 new universal beam and column section sizes in addition to the firms old specifications.

Building
6 October 2006
Green warehouse
Designed by Aukett Fitzroy Robinson the 5,000m^2 steel framed centre is said to be Britain's greenest storage space. Built by Haymills for brewer Adnams, the warehouse is in Southwold, Suffolk.

Building
6 October 2006
Cost comparison
The project team compared the cost of using a steel contractor and a timber frame contractor, and found out that the former offered not only better prices but could also use his expertise to subcontract the timber package.

Contract Journal
27 September 2006
EC to review European laws
The European Commission (EC) has launched a review of the European Union's (EU) metal industry laws and policies following increasing competition for supplies from China.The EC wants advice on how to develop design standards to enhance metals recycling and how technical guidance on using alloys should comply with the EU's REACH chemical controls.

Corus seminars at Civils 2006

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Corus offers a wide range of products and services to the UK construction industries, many of which will be showcased on its stand (D20) - including Advance, the new name for structural sections - at this year's Civils exhibition being held at London Olympia from November 28-30.

Those visiting the exhibition on Wednesday 29 November will be able to find out more about designing and building in steel as Corus will be hosting a programme of free technical seminars including presentations by many leading experts.

The full Corus schedule is:

10.00 *Integral weathering steel bridges,* David Place, Mott MacDonald
10.30 *Efficient steel bridge fabrication,* David Dickson, Fairfield-Mabey
11.00 *Construction of the Finnieston Bridge,* Giles Waley, Edmund Nuttall and Peter Miller, Watson Steel
11.30 *Monitoring and refurbishment of movable bridges,* Mark Pearse, Corus Railway Infrastructure Services
12.00 *Jamestown Viaduct - innovative strengthening of an early steel viaduct,* Andy Hanson, Corus Railway Infrastructure Services
12.30 *Challenges of providing structural supports to OLE installation into St Pancras on CTRL,* Keith Moverley, Corus Railway Infrastructure Services
13.00 *Barnsley Transport Interchange,* Mike Fewster, Billington Structures
13.30 *Emirates Stadium Roof,* Geoff Werran, Buro Happold
14.00 *Steelwork solutions for recent West End buildings,* Martin Feakes, whitbybird
14.30 *Corefast building core system,* Robert Fisher, Corus Bi-Steel and Andy Ashley, Ocon Construction
15.00 *Latest developments in composite floors,* Adrian Wallwork, Corus Panels and Profiles
15.30 *Protect 365 bridge parapet system, Bill Russell,* Corus Tubes
16.00 *Sustainable foundations, David Rowbottom,* Corus Construction and Industrial

Anyone wishing to attend a seminar needs to pre-register for the exhibition at www.civils.com

European steelwork industry in good shape

Delegates to the recent annual conference of the European Convention for Constructional Steelwork (ECCS) reported an overall sector that is gaining market share.

Held in Poiana Brasov, Romania, the conference was attended by more than 100 delegates from most of the European member countries.

Geoffrey Taylor, Marketing Director of Caunton Engineering and Editor of the ECCS annual statistical bulletin, commented: "Some countries spend a great deal researching their annual statistics, for although domestic steelwork industries cannot influence their market size they can influence the market share."

"In the UK for instance, Corus has been investing in its research since the 1970s and seen steel's multi-storey figure climb from 30% to 70%," he added.

Corus' statistics showed how the Dutch and the UK steelwork industries continue to dominate their single storey markets - both over 90%.

Meanwhile, France has 60% of its single storey market and Norway slightly more than 50%. "Other member countries' market share returns are not so specific, and in certain cases not carried out at all," Mr Taylor said.

Some countries reported particular threats to their steelwork sectors. Austria and Switzerland both reported official and substantial promotion of timber framing, while some of nations said the recent steel price rises had threatened their domestic fabrication industries.

On a positive note, the Danish market is booming and Turkey said its first high-rise steel framed building was recently completed in Istanbul.

- World steel production is predicted to top 1.2bn/t in 2006 according to the latest forecast by MEPS. This will represent an increase of 7.5% compared to 2005 and will be the fifth consecutive year steel production has increased by more than 5%.

Albion investment ups production

Albion Sections said a recent £1.2M investment, which included a new fully automated and dynamic Bradbury roll forming mill, will see its annual production increase to 7,000t for 2006.

"Last year we produced 5,000t," John Jones, Managing Director of Albion Sections said. This year, due to our investment we actually have the added benefit of an additional 6,000t capacity," he added.

The investment has also included new company software and some major remedial works at its West Bromwich facility.

"We had to relocate and remove some machinery in order to install our new processing line," Mr Jones explains.

The new line has also provided a firm foundation to continually meet the changing demands for the usage of cold rolled products within the steel construction industry.

Mr Jones said the company has seen an increasing demand for cold rolled sections to provide solutions for existing labour intensive and heavy processes.

"We've seen our mix of products change in the last five years. Previously we made 80% Zed products and 10% Cee products, compared to 50% Zed and 40% Cee now," Mr Jones said.

Welding consumables to be CE Marked

As from 1 October this year the CE Marking of welding consumables has been allowed under the harmonised standard BS EN 13479: 2004.

"This has legal implications for steelwork contractors who supply welded fabricated steelwork," David Moore, BCSA Director of Engineering said.

In the UK all construction products must satisfy the Construction Products Regulations (CPR), and to ensure compliance the BSCA is advising its members to take the following action.

The BCSA advices reducing existing stocks of non-CE Marked welding consumables, changing technical specification to CE Marked products, and to ensure that all welding consumables provided since October comply with and are CE Marked.

Those who do not purchase CE Marked welding consumables need to ensure that the products comply with the CPR, and also need to retain information on their material properties, the name of the manufacturer and details of the manufacturer's quality system.

"Many steelwork contractors may have stocks of welding consumables which are not CE Marked," Mr Moore said. "According to the European Commission any construction product that is placed on the market before the start of CE Marking is not required to be marked once the harmonised standard comes into force. Therefore, companies can use existing stocks but they must satisfy the CPR."

Safety lessons to be learnt

The lessons learnt from major accidents will be the main topic at the Fire and Blast Information Group (FABIG) 48th technical meeting.

Kevin Allars, Deputy of the HSE's hazardous installations directorate will give the keynote speech, while a number of high-profile speakers have been invited to present the findings from recent major accidents that have occurred on offshore platforms and onshore plants.

The forum is jointly organised by FABIG and the Safety and Loss Prevention Subject Group (SLPSG) of the Institution of Chemical Engineers and will be held on 6 December at the London School of Economics at Bankside.

Attendance is free for FABIG members, and £112 (excluding VAT) for non members.

For information contact Dr Viken Chinien at the SCI, Tel: 01344 636548.

New bridge by-passes Barford

Rowecord Engineering has recently completed the fabrication and erection of a 120m–long bridge serving the new Barford bypass in Warwickshire.

The structure consists of 350t of steel, with girders sitting on reinforced concrete supports, traversing a river and floodplain on the village's western perimeter.

Danny Brown, Site Agent for main contractor Galliford Try said the problem this created was that normally a bridge would be supported on dry banks with a spanning beam just sitting there, but here all the ground was totally sodden.

To combat this, a temporary hardstanding was first put down on the floodplain to support plant equipment before a comprehensive piling programme was carried out.

Ian Hoppe, Bridges Director for Rowecord, said a crawler crane was used to lift the majority of steel as this type of machine spreads its load better than a telescopic crane with outriggers. "We lifted all the steel beams individually except the section over the river," he added.

This 32m-long section was assembled adjacent to the site and lifted in two pairs of braced girders, each weighing 51t.

To lift these bridge sections an 800t capacity mobile crane was used and this was positioned on the southern abutment of the structure. "Luckily we found a position for this big piece of kit, as it would have been to difficult to construct hardstanding and foundations for it," Mr Brown said.

Steelwork for the bridge was completed in September and the bypass is due to open in early 2007.

NEWS IN BRIEF

A new website, designed, built, run and maintained by the SCI on behalf of **The Step Change in Safety Team,** has been launched. The site brings together information from companies, contractors and trade associations involved in off-shore oil and gas exploration and production.

Since updating the **CDM regulations**, the Health & Safety Executive has asked the industry to write the guidance documents. Six working groups have been established under the Construction Industry Advisory Committee to develop guidance for: client; coordinator; principal ontractor, designer contractor and individual worker. The documents are likely to be published in January 2007.

SCI ICT has released a new version of its cellular beam software, **CELLBEAM Automate V6**. The package is distributed by Westok and contains a module which enables the fire design of cellular beams by adjusting material properties as the member is taken through the ISO fire curve temperature profile.

The Specialist Engineering Contractors (SEC) Group has updated its list of clients not using **retentions**. A full list is available on the Group's website www.secgroup.org.uk Rudi Klein, SEC Group's Chief Executive, estimated that over 12% of the industry is a retention-free zone.

All steelwork contractor companies applying for **BCSA membership** must now undergo a technical audit visit to be repeated every three years. An interim audit in the two years between full audits will be needed.

Irish contractor SIAC Construction has acquired **Bison Structures**, the steel division of the Bison Group.The company is now known as SIAC Tetbury Steel and will continue to be managed by the existing executive team with all employees remaining in place.

Sustainability award gets SCI sponsorship

The SCI will sponsor the David Alsop Sustainability category at this year's Institute of Structural Engineers' Awards (IStructE).

The IStructE annual awards recognise the work of the world's most talented structural designers and their contribution to the built environment and are considered to be pre-eminent within the industry.

"We believe structural engineers have a key role to play in delivering sustainable development through integrated thinking, design excellence, efficient material usage and mindfulness of water, site and the local community," Dr Bassam Burgan, SCI Deputy Director said.

"We are therefore very pleased to be the 2006 sponsors of the Institution of Structural Engineers' David Alsop Sustainability award," he added.

The IStructE Structural Awards 2006 will be held at the East Wintergarden, Canary Wharf in London on 8 November. For more information go to website: www.istructe.org.uk

As part of its activities to support sustainable development, the SCI will also be the official sponsor of the Building Group Sustainable Awards ceremony 2006. This event takes place at the London Park Lane Hilton Hotel, on 20 November.

Caunton builds Honda extension

A major expansion project at Honda's car manufacturing plant in Swindon has recently been completed by Caunton Engineering.

During a 10-week programme, Caunton supplied and erected approximately 1,000t of structural steelwork for an extension to the existing production facility, a new plastic operations building and two mezzanine links over the main thoroughfare.

Tony Goodman, Caunton Engineering Contracts Manager, said the company is no stranger to the location, having worked there regularly during the past four years.

"We have been able to give Honda the service and steel construction they require," Mr Goodman added.

Caunton has extended the existing production facility by a single 18m-wide bay at the north end in one direction and four 15m wide bays at the south end in another direction.

"We also had to erect steelwork over an existing roof and this required some 27m-long 3m deep trusses," Mr Goodman said. "All of this work was completed without disrupting their production operations," he added

The new plastics operations building will produce items such as bumpers and measures 120m x 20m. It contains a mezzanine level at an 8.2m height. Mr Goodman said the structure is basically a stick and beam building with large 10m and 12m grids.

"Car manufacturers generally require large open column free areas for their production machinery such as long conveyors," Mr Goodman explained.

Caunton also erected two mezzanine links connecting the new building to the existing facility over a main road.

Because the links traverse a major delivery thoroughfare within the Plant, Caunton had to erect both structures over a number of weekends.

Weathering steel for Eden River

As part of the 5km-long A66 Temple Sowerby bypass in Cumbria, Fairfield Mabey, working as Skanska Construction's steelwork partner for the Highways Agency, has successfully supplied and erected a bridge over the environmentally sensitive River Eden using weathering steel.

"The river is of special scientific interest because of the wildlife," Ashley Cooper, Project Manager for Fairfield Mabey explained. "During the design process the decision was taken to build the bridge with weathering steel, which doesn't corrode beyond the initial Patina, and means there is less risk to the area from the painting operations that would typically be required for a bridge, both during the construction and the maintained life of the structure," he added.

The Eden River bridge has three spans, two at 34m and a central span of 64m and is four girders wide (25m).

It is a multi girder composite steel and concrete structure with members of varying depth from 1,600mm at the abutments and central span, to 3,300mm at the haunches.

Mr Cooper said more than 1,200t of steel was used for the bridge which was delivered to site in five sections and pre-assembled into three main lifts per girder length.

The bridge works began at the beginning of October and will be completed in mid November with the entire Temple Sowerby bypass opening in 2008.

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Overground underground

Inside the steel turret

Among some prestigious and highly visible steelwork at Heathrow Terminal 5, one contractor has completed some equally important steelwork below the surface, on the surface and even above the site. Martin Cooper goes air-side to find out more.

When it opens in 2008 Heathrow's £4.3bn Terminal 5 (T5) will be one of the world's most advanced airport facilities, boasting 65 aircraft stands with 14 capable of accepting the largest double-decker jumbos such as the Airbus A380 or the Boeing 747-800.

T5 actually includes three new steel-framed terminal buildings, while other construction work has included a new air traffic control tower, a 4,000 space multi-storey car park, a hotel, 13km of bored tunnels and an array of other airfield infrastructure.

Once complete, it is estimated that more than 45,000t of steelwork will have been used on the airport project. Among this huge amount, Glentworth Fabrications says it has recently fabricated, supplied and is installing close to 1,000t of galvanised steelwork on a range of ancilliary works underground, on the surface and even above the project.

Bob Harrison, Glentworth's Managing Director, takes up the story: "We've installed steel for ventilation shafts going deep into the new underground extension tunnels, while on the surface our ventilation shaft steel at the multi-storey car park is just visible."

But where's the steelwork above the project? Well it turns out Glentworth Fabrications' sister company Glentworth Precision Engineering has manufactured parts for the wings of the A380.

"When the first Airbus super jumbo recently landed at Heathrow it flew over our work at T5," Mr Harrison explains. "We immediately said to ourselves now we've worked under, on and over this prestigious project."

And he's right, and just to clarify the underground element even further, Mr Harrison also adds that another group company, Glentworth Rail, has recently completed modifying carriage auto-couplers for the entire fleet of rolling stock on London's Central and Waterloo & City lines.

But keeping to the subject of construction steelwork, Glentworth's work at T5 has taken on a variety of guises. The biggest contract the company has completed, so far, has been the fabrication, supply, erection and installation of four steel turrets,

Lifting the steel turrets into the car park's ventilation shafts.

FACT FILE
Heathrow Terminal 5, ancilliary works
Main client: *BAA*
Structural engineer: *Arup*
Main contractor: *Balfour Beatty, Amec & Hotchkiss*
Steelwork contractor: *Glentworth Fabrications*
Project value: *£3M*
Steel tonnage: *1,000t*

complete with ventilation fans and staircases, for the multi-storey car park.

Working on behalf of Balfour Beatty, Glentworth constructed the four units - each requiring more than 100t of galvanised steel - on the airfield's apron.

"Although our jobs haven't been the biggest contracts on T5, this job was logistically challenging," explains Brian Mosey, Glentworth Fabrications' Contracts Director. "In order to speed up the construction process we built the ventilation turrets on site and installed them during two 48-hour weekend possessions," he adds.

The steel turrets are 9.5m in diameter and 48m-high, and Glentworth's contract also included installing all the relevant plant and equipment, which added a further 65t to their overall weight.

Constructing the turrets next to a live runway presented a number of obvious challenges, but once complete the units had to then be transported one mile across the airport to the multi-storey car park. "There wasn't room near the car park to build the units so moving them required four mobile cranes at two locations and a special lowloader which moved the turrets at 5mph across the airfield," Mr Mosey says.

Using a 1,000t and a 500t capacity mobile crane to install the turrets into the car park's concrete ventilation shafts was a very tricky procedure as there was only a 40mm clearance. "The lifts had to be exact as the turrets had to fit on to pre-installed holding bolts at the bottom of the 30m-deep shafts," Mr Mosey adds.

So successfully were the turrets installed over the two weekends, that Glentworth was able to bring the car park's construction ahead of schedule. Wayne McKnight, Glentworth Fabrications Contracts Manager explains: "The concrete pouring was running late, but after we'd installed our steel units the job was actually two weeks ahead of schedule."

"The concrete pouring was running late but after we'd installed our steel units the job was actually two weeks ahead of schedule."

The four ventilation turrets were all clad with aluminium louvres before being installed during July, and once in position a final top section was bolted on. "It is these sections which are visible at ground level," Mr Harrison explains.

Installing steelwork in ventilation shafts may have become a bit of a speciality for Glentworth at T5 as the company has also fabricated and installed two steel risers for the new terminal's underground extensions.

Again working on behalf of Balfour Beatty, Glentworth constructed two galvanised steel units, containing emergency staircases and handrails, on a site adjacent to the shafts. One unit was installed in the 38m-deep shaft D for the new Piccadilly line extension at T5 and the other was inserted into the 32m- deep shaft C which serves the Heathrow Express extension.

"We used approximately 100t of steelwork for each shaft," Mr Mosey says. "And we erected the complete riser, including stairs, floor by floor, tying the structure into the concrete wall via brackets."

The company used a 25t capacity mobile to lift individual members down the shaft, and these were then bolted together. Five levels of stairs were also lifted into position individually. Separating stairs and vents, a concrete fire wall was also added.

Glentworth has also installed some galvanised steelwork inside the main T5 terminal building. A total of nine ducts inside the main lift and stair cores of the structure required decked maintenance platforms for the electrical risers.

A further on-going Glentworth contract at T5 involves the company working for Amec and installing fire damper access platforms at eleven locations on the underground extension.

Working deep beneath the T5 project brings with it a whole host of unique challenges including transporting all steelwork by trolley along the extensive tunnel network.

The access platforms are 9m^2 in plan, are fully decked and also have steel handrails. As the underground works are currently on-going, Glentworth is having to work around Amec's programme, and consequently the fire access platforms are being installed intermittently.

"We take on the jobs the big boys don't want," Mr Harrison says. "The work at T5 hasn't been the most prestigious, but it is still important steelwork," he sums up. And, of course, not forgetting the company has had the opportunity to work on three levels at T5: underground, on the ground and overground.

Below: The turrets were erected alongside a live runway

High speed construction

A new state-of-the-art office block in Leeds has demonstrated the speed, flexibility and ease of steel construction.

Above: The office block has a canalside location.
Right and Below: Westok beams allow open-plan areas throughout.

Clarence Dock, in the centre of Leeds, is one of the largest on-going mixed use developments in the North of England. Situated adjacent to the popular Royal Armouries museum, the £250M scheme will eventually provide more than 500,000ft^2 of cafe bars, shops, restaurants, a 131-bed hotel, a casino, more than 1,100 luxury waterside apartments and modern office space.

The project forms part of the post industrial regeneration of Leeds' 200-year old dock area and it is hoped with the aid of its canal side location, it will become a popular tourist destination. When complete in 2007, the developer, Crosby (Yorkshire), expects 1.5M visitors each year.

Nestling alongside the project's five concrete framed apartment blocks is Livingstone House, a six-storey steel framed office block.

Once complete the building will offer 75,000ft^2 of state-of-the-art office space with secure parking for 33 cars at basement level. Its design centres around a two-storey entrance foyer with full height glazing directly overlooking the waterside.

Deciding to build a steel office block amidst several concrete structures was down to several factors, says Sean Jones, Construction Manager for main contractor Shepherd Construction.

"Building with steel is quicker," he says. "But we also needed greater open-plan spaces for the offices compared to the residential blocks and steel lends itself to longer spans."

Consequently the structure is a six-storey beam and column block from basement level up, with composite concrete floors throughout and a concrete slab and retaining walls in the basement.

However, prior to constructing the building, the canal side location and a very high water table meant a major piling operation was required. On this phase of the project more than 300 piles were installed to depths of 17m and the site needed to be continually pumped.

The ground conditions at the site consist of fill materials overlying dense gravels, which in turn are underlain by variable interbedded weak mudstones and strong sandstones. This variability demanded a rigorous validation process for both pile design and installation characteristics.

Once piling work had been completed the concrete basement slab and retaining wall were poured. Billington Structures then began the

steelwork erection which was completed in a speedy 12 weeks.

In order to optimise the construction process Billington began by erecting the building up to the third-storey. Once the floor slab was poured at this level it acted as a crash deck for further works to be carried out below. "From the third floor, steelwork was able to proceed to the top level, while we worked down from this level, pouring the floor slabs and the central core," Mr Jones explains.

"Using steel allowed trades and work to overlap and this wouldn't have been possible with a concrete framed building," Mr Jones adds. "With concrete the formwork dictates that the structure must be constructed from bottom to top, but with steel there is far more flexibility."

"Using steel allowed trades and work to overlap and this wouldn't have been possible with a concrete framed building."

Gary Hearnshaw, Billington's Project Designer, says to give the office areas the desired open-plan design long span Westok beams were used throughout. The building has a footprint of 37.5m x 33.75m and this was divided into five bays along the main elevation each 7.5m wide.

"In this way all the floors, which are all identical, had no internal columns, as the longest beams all radiate out from the central main core," Mr Hearnshaw explains.

From the core to both of the side elevations the long Westok beams supporting the floors are typically 16.2m long, and vary in depth from 750mm to 680mm deep on all floors. Intermediate 7.5m long beams were also used, to connect to the other two elevations, and these are 540mm deep.

Constructing up to the third level also meant that the main perimeter columns, which start at basement level, were spliced at 500mm above this floor. These 17m-long main columns are 356mm x 356mm below the splice, changing to 305mm x 305mm on the upper levels, and spaced at 7.5m centres.

To erect the steelwork one of the five tower cranes Shepherd Construction currently has working on the development was used, while Billington also had a 25t mobile crane on site.

"The building is hemmed in on three sides so delivering materials had to be done on a just-in-time basis," Dave Higgins, Billington's Project Manager, explains.

"The road outside the site is a narrow one-way street so unloading had to be done relatively quickly," Mr Jones comments. "Some of the other concrete structures we're building at the moment require far more space for the delivery of equipment and materials," he adds.

Also included in Billington's contract was the supply and installation of 8,500m^2 metal decking throughout the building, while the company also erected two external steel staircases which will be used as emergency exits.

Livingstone House is due to be finished in early 2007, and the entire Clarence Dock development is scheduled for completion in September of the same year.

FACT FILE
Livingstone House, Clarence Dock, Leeds
Main client: *The Clarence Dock Company (Crosby Yorkshire)*
Architect: *Carey Jones*
Structural engineer: *Buro Happold*
Main contractor: *Shepherd Construction*
Steelwork contractor: *Billington Structures*
Steel tonnage: *620t*

Above: Steelwork was completed in 12 weeks. Left: Steel erection began at basement level.

New source for health and safety help

BCSA has launched a new subsidiary company designed to help members cope with growing health and safety regulatory requirements. A national network of advisers is already in place, as Nick Barrett explains.

A new health and safety service has been launched by the BCSA to provide members with broader and more in depth help with safety related matters. The service is available through a new BCSA subsidiary company – Safety in Steel Construction (S!SC) – and is aimed primarily at companies without a full time health and safety manager, providing them with the 'competent person' demanded by health and safety legislation.

A trial involving three BCSA member companies was successfully run in 2005 to provide the necessary in depth information needed to design the S!SC service. 'We wanted to be certain what the key issues would be for providing health and safety support above and beyond the level of support we ordinarily offer members,' explains BCSA Health and Safety Manager Peter Walker. 'We are normally only able to offer a relatively limited health and safety support to members but several had asked if more could be done, particularly to ensure that a competent person was available as required under legislation. Some also wanted practical help with implementing health and safety within workplaces.'

It is a requirement of the Health & Safety at Work Act that every employer appoints one or more competent persons to assist with the statutory requirements. Subscribing companies will be able to quote S!SC as their 'Competent Safety Advisor'. Companies with their own existing in-house safety professional may also benefit from SiSC's assistance and support. Subscribing companies may use the SiSC logo on their stationery and literature.

The BCSA has found that some companies need help with ensuring that all the relevant paperwork statutorily required is in place and that adequate monitoring and measuring of safety performance is carried out. The BCSA fears that there is a danger that companies could find themselves being prosecuted for technicalities, even though they are fully committed to health and safety. 'A classic example of that would be not having a nominated competent person with the relevant education, experience or training,' says Mr Walker, 'or using an external health and safety consultancy that does not fully understand the implications of some of the regulations as they apply to construction.'

The new service is available throughout the UK via a network of 24 regionally placed providers.

S!SC

Safety in Steel Construction

The BCSA keeps them updated with background information on what is currently specifically affecting the industry, and on the latest good and bad practice issues.

Mr Walker said: 'The Health and Safety Commission (HSC) are currently working with the Institution of Occupational Safety and Health (IOSH) on a joint statement on 'obtaining competent health & safety assistance'. The BCSA believes S!SC will ensure that the "competence" element of the service is provided and maintained. This issue of competence will also be re-emphasised in the requirements of the revised CDM Regulations to be released in April 2007.'

The new service is available throughout the UK via a network of 24 regionally placed providers

The existing health and safety service available to BCSA members through Mr Walker will continue, but much of his time is taken up on developing national policies for the industry in liaison with the Health and Safety Executive, and monitoring and advising members about regulatory and clients' changing requirements.'

BCSA Director General Dr Tordoff said: 'This new service is not an intrusive external audit, but is a positive promotion of health & safety that can be used to the benefit of the whole of a company's workforce. Further services are available from S!SC at additional charge, such as senior input to management meetings or liaison with clients, fast response to serious accidents, correspondence with HSE, contingency planning, training, etc.'

For information contact Pete Walker Tel: 01325 366328 or Email: *pete.walker@steelconstruction.org*

Steel takes the honours

Three new steel-framed buildings form the initial stage of the University of Reading's on-going redevelopment programme. Martin Cooper goes on campus.

Above and right: The new Students' Union building was erected in one week.

This year the University of Reading marks its 80th anniversary, and coinciding with this milestone it has embarked on a redevelopment scheme which will see a number of new extensions and buildings taking shape over the next couple of years.

Initially this involves three steel-framed structures; an extension to the Wolfenden Sports Centre, an extension to the Students' Union building and a brand new Student Services Centre.

Steelwork contractor James Bros (Hamworthy) has an involvement with all three structures, working with main contractor Warings. The first scheme to get under way earlier this year was the two-storey extension to the Sports Hall.

Michael Pryke, James Bros. Director says 28t of hot rolled steel and approximately 3t of cold rolled steel was used on the Sports Hall.

The steelwork was erected by a three-man gang in just one week. "This structure pretty much sums up why a smallish contractor like us can do a job like this professionally," Mr Pryke says.

"In the method statement it stipulated there should be no interaction between our workers and students using the existing parts of the Sports Hall," Mr Pryke explains. "So we utilised a father and two sons team that we've employed before on a number of similarly sensitive projects."

"The steelwork was erected by a three-man gang in just one week."

Another aspect of the project has been the need for flexibility, as once the steel frame was erected the wall separating the old and new parts of the complex needed to be partly demolished which required supporting steelwork to be inserted.

"This part of the project changed once we'd finished the frame," Mr Pryke explains. "Instead of the entire wall only a portion is to be knocked down now, so we need to go back and erect one supporting column in two separate pieces."

"Luckily we're already on site doing another structure so we can send our gang over easily to finish the job, but I reckon many larger contractors wouldn't react so quickly and positively to these little changes," he adds.

The Sports Hall extension has a footprint of 16m x 11m and will house additional changing rooms on the ground floor and administration offices on the upper level.

The second steel structure to be erected was the extension to the Students' Union block. The steel for this building was erected in September, again in one week and by the same family gang.

The structure covers the footprint of a demolished building and will link into the old adjoining Student's Union facility. James Bros. used approximately 45t of steel for this two-level building which is 30m-long x 18.5m wide. Column sizes were mostly the same as the Sports Hall with 203 UCs being used, while beams were predominantly 406 and 356 UBs.

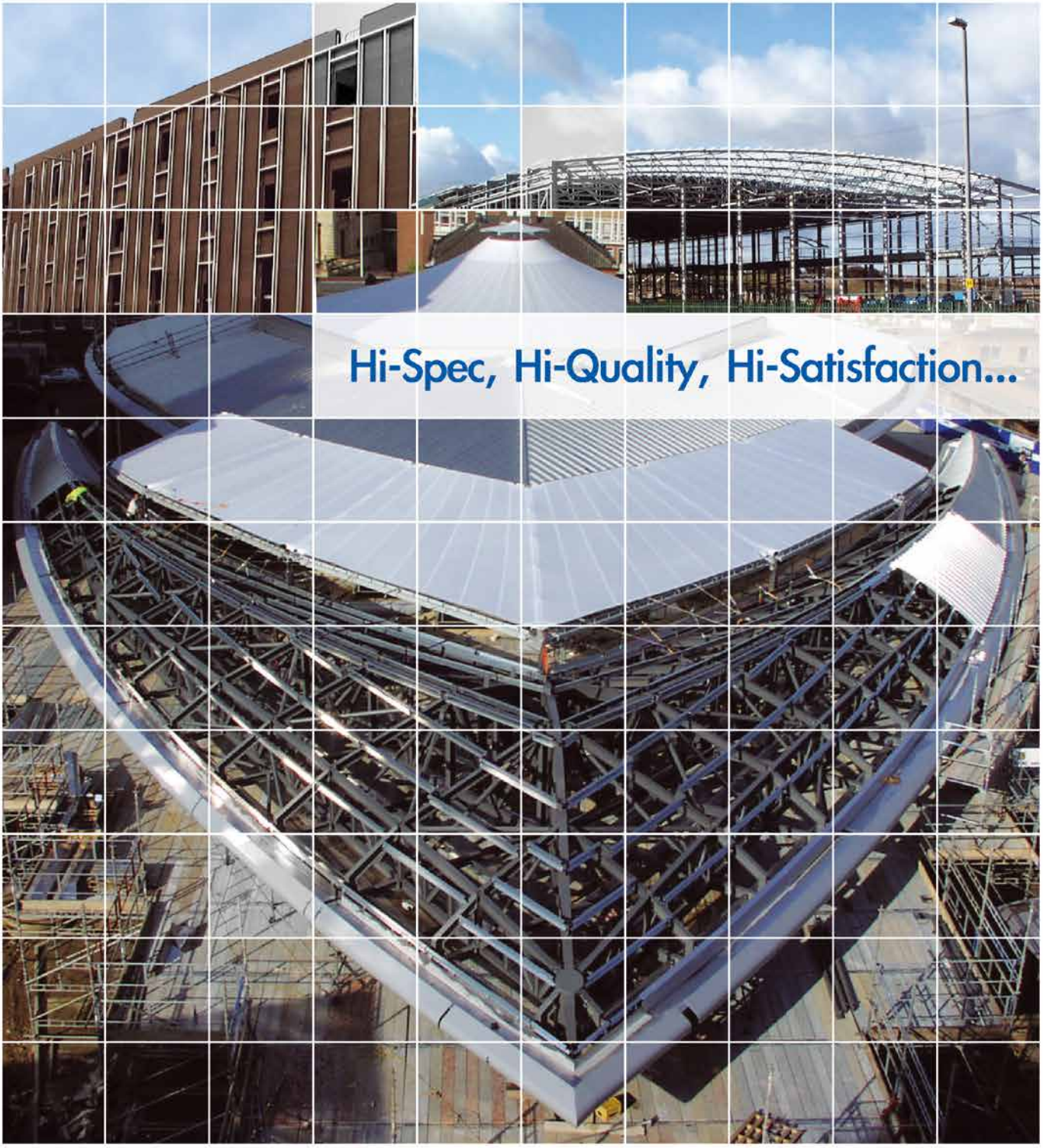
Finally, at the end of October steelwork began on the third part of the job; the Student Services Centre which has been named the Carrington Building in honour of the Rt Hon. Lord Carrington, Chancellor of the University since 1992.

Mr Pryke says this free-standing three-storey building will require approximately 140t of hot rolled steel, while his company's contract also includes installing 2,000m^2 of metal decking.

"This is basically a stick and beam job and we envisage completing the steelwork and decking in about five weeks," Mr Pryke says. "Ideally we'll be using the same team again as our client and the University have got to know them for their good professional approach and manner."

The Student Services Centre will house a disability office, accommodation, student financial support office as well as a careers advisory desk. It is due to open in time for the 2007 Autumn term.

FACT FILE
University of Reading Campus extensions
Main client: University of Reading
Architect: Stride Treglown
Structural engineer: WSP
Main contractor: Warings Contractors
Steelwork Contractor: James Bros (Hamworthy)
Steel tonnage: 220t



Glasgow banking on steel

One of Glasgow's most iconic buildings is getting a new steel framed interior behind a retained 1920s listed facade. Martin Cooper visits the former banking headquarters which is set to become a stylish city centre office block.

The old headquarters of the Bank of Scotland at 110 St Vincent Street in Glasgow is undergoing a complete refurbishment.

The building situated in the heart of Glasgow's central business district and designed in 1925 by architect James Miller, has been described as one of the city's most striking structures. It has a Grade A listing which requires the facade and ground floor Banking Hall to be 100% retained during any structural alteration.

Renovating an old structure can invariably throw up a number of challenges, not least marrying old materials to new. Raymond Slaine, Director at Goodson Associates says this project was no exception.

"Fortunately we located the original drawings and this was a great help when designing the new steel frame into the building," Mr Slaine explains. "We surveyed the existing steel in the facade and discovered it was in good condition for its age, but we also found the alignment is slightly off," he adds.

"We surveyed the existing steel in the facade and discovered it was in good condition for its age"

The biggest challenge was then actually fitting the new frame within the retained facades. The building is the best fit for the site but it is slightly off centre. With the aid of the original plans and modern 3D modelling, Goodson and steelwork contractor Rippin Steel had to design tolerances of +/-15mm into connections for the new columns and beams which married into existing retained steelwork. "By building in tolerances we were able to plot a perfect grid plan on the new levels," Mr Slaine says.

The majority of the construction work consists of installing new interior floors giving increased floor to ceiling heights above the two level banking hall. The old interior was completely demolished leaving an empty shell to be in-filled with a new steel frame. Previously the building was a U-shaped block arranged around a 12m x 20m lightwell. This has been filled in to form a new larger open plan office space of 12,000ft^2 on seven levels, which includes a new fully glazed terrace floor at the roof level.

"Steel was always going to be the material of choice," Mr Slaine explains, "as there is more flexibility in the design, and it was essential for forming the connections between the original and new steel."

All structural steelwork has been carried out by Rippin Steel, whose Managing Director David Jamieson says about 700t of steel has been used for the new structure above the Banking Hall, while a further 100t was utilised on the refurbishment of the lower levels including the project's two basement levels.

"A key part of the work involved filling in the lightwell above the two retained floors of the listed Banking Hall," Mr Jamieson says.

"The upper levels had already been demolished, so the listed Banking Hall could have been exposed to the elements if we'd not planned how best to install the two levels of steel in-fill sections within the former lightwell," Mr Jamieson adds.

In order to protect the ground floor, Rippin installed the beams for both floors at second floor

FACT FILE
110 St Vincent Street, Glasgow
Main client: St Vincent Street Development
Architect: Holmes Partnership
Structural engineer: Goodson Associates
Main contractor: Balfour Beatty
Steelwork contractor: Rippin Steel
Project value: £20M
Steel tonnage: 800t

Main picture and above: A steel interior will replace the old floors above the retained lower levels

level. Once the upper level had been installed, including the composite concrete slab, it acted as weather protection for the floor below. The first floor beams, which had been slung temporarily under the second floor were then chain blocked into place.

This tricky procedure involved Rippin installing approximately 40t of steel which included four 13m-long 5t main beams for each of the two floors and a host of secondary 203mm x 133mm members.

Bolting the new columns to the old members was another very challenging aspect of the job.

The 23 original internal columns were retained throughout the Banking Hall and cut 1m above the second level.

Bolting the new columns to the old members was another very challenging aspect as Mr Jamieson explains: "We had to grind the old columns flat and then add a plate for the new columns, ensuring each member was completely level," he says.

"We had to tweak this part of the grid by one degree to get a perfect plan," Mr Slaine explains.

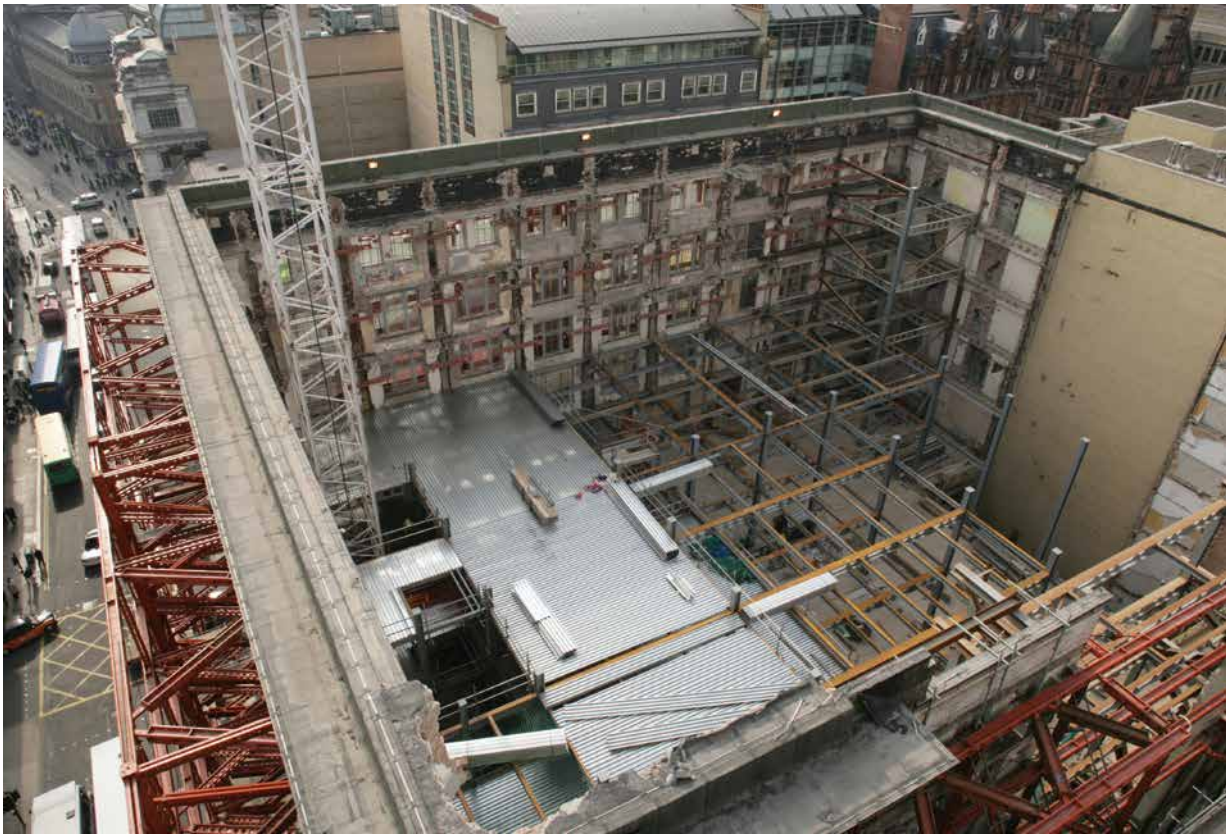
Rippin's steel erection programme for the interior worked by splitting the structure into thirds and working east to west. Two storeys were erected with the decking in each third, and when complete Rippin moved onto another third allowing Balfour Beatty to follow behind and pour the concrete slab.

The building's two basement levels are also being refurbished with level -1 being turned into a secure car park for 25 vehicles which will be served by a car hoist (lift), while level -2 will be a storage area.

To give the car park more open space Rippin had to take out two internal columns and replace them with two 9m-long double transfer beams, each weighing 4t. Getting large sections of steel into the basement area wasn't easy. "The columns had to be lifted down one of the cores and then carefully manoeuvred across the basement floor on a trolley as no large equipment could gain access," Mr Jamieson explains.

"Then to position and erect the beams we positioned A-frames on the floor above and hoisted the beams into position with chains hung through pre-drilled holes in the concrete floor," Mr Jamieson says.

The building is scheduled for completion in the Spring of 2007, almost exactly 80 years after it first opened its doors for business. In the words of the project's architects Holmes Partnership, Glasgow will have acquired a high-specification office block incorporating large floorplates and a magnificent fully restored 'banking hall' entrance.



Left, top and bottom: The fully restored facade and Banking Hall. Above: The new steel levels take shape. Right: The new floors will include a terraced seventh level.

Steel delivers flexibility to Derby shops

A 1970s complex is being expanded with a new steel framed extension to create one of the East Midlands' largest shopping centres. Martin Cooper takes a stroll through Westfield, Derby.

Three new malls link into the existing centre

More than 11,500t of steel will be erected by Rowen Structures for Derby's new Westfield Shopping Centre, one of the largest projects it has ever been involved with.

Working on behalf of the main contractor – Australia's Westfield Shoppingtowns – Rowen has been on-site since January 2005, and erecting this not insubstantial amount in earnest since the Summer of 2005.

Steve Dobbs, Rowen's Contracts Director, says the majority of steelwork will be completed by the end of the year, but what has made this project interesting is the volume of steel.

"Originally the contract required about 8,500t of steelwork," he says. "Then once construction got underway the plans changed with the addition of a cinema complex giving us the present 11,500t total."

The project entails not only the construction of new retail and leisure space but also the refurbishment of the existing shopping centre. Once complete the site will provide over 1M/ft^2 of new and upgraded retail and leisure spaces, which will include more than 100 shops and two large anchor department stores, a 12-screen cinema, an 800-seat food court and 3,700 car parking spaces.

The new shopping centre, which has a floorplan of 60,000m^2, wraps around and over the old structure. The original early 1970s shopping centre is a concrete building. However, according to Scott Crawford, Structural Engineer for MPN, the decision was taken early in the planning process to build the new development with steel.

"The site is confined by two busy roads and the existing shopping centre," Mr Crawford says. "So bringing plant equipment and materials on to site was always going to be difficult and was one of the project's most challenging aspects."

The geometry of the new structure is consequently dictated by the curved layout of the roads which bound the site, and the need to link three new internal malls with the existing centre.

"It was decided to use steel for the new build because the material lends itself to off-site fabrication, which is an important issue on a site with little room to stockpile," Mr Crawford says.

"A concrete structure would have meant far more city centre disruption and more plant equipment on a very tight site," he adds.

However, delivering more than 11,500t of steel to a city construction site also presented some challenges to Rowen Structures. "Most of the steel members were delivered to site in complete sections and erected almost immediately," Mr Dobbs explains. "This helped with the construction process and limited having to stockpile materials."

"Steel lends itself to off-site fabrication... A concrete structure would have meant far more city centre disruption..."

FACT FILE
Westfield shopping centre, Derby
Main client: *Westfield shoppingtowns*
Architect: *WDE*
Structural engineer: *MPN*
Main contractor: *Westfield*
Steelwork contractor: *Rowen Structures*
Project value: *£340M*
Steel tonnage: *11,500t*

Above: Mobile cranes erected steel up to the fourth level. Right: Long span beams were erected over the new malls.

Once work got started the initial phase included refurbishing and extending the existing Victoria Chambers, a four-storey Victorian office/retail building on a site opposite the main Westfield site, to provide accommodation for three relocated existing tenants. This involved demolishing most of the existing masonry load-bearing walls on the ground floor to provide an open plan, which required a new steel frame to be inserted into the building to hold up the upper floors.

Once this phase was complete, the demolition of some of the old existing shopping centre and two 1970s office blocks could commence to clear the site for the new development. The cleared area was then excavated down to a depth of 7m and a steel sheet pile retaining wall built around the new basement level.

The floor of the basement is concrete, but the construction from here on up is entirely steel, except for the concrete used to form the composite floor slabs.

The basement area will be a delivery and loading area, while above this there will be three levels of retail and five levels of car parking. Meanwhile, sitting on top of the existing shopping centre there will be a two-storey cinema block.

"The vast majority of the steel erection is typical stick and beam," Mr Dobbs says. "There just happens to be a lot of it and getting it on to site was the challenge."

When the project began, Rowen was able to use three access points for steel deliveries, but as the job progressed only one entry point remained open.

"Normally you'd construct a building from one end to the other, but on this project we've had to work around the existing building," Mr Dobbs says. "This meant we lost two access points when the new building went up. And then the cinema complex was added, which slightly complicated our erection procedure."

Columns for the entire shopping centre and car park vary from 254s, 305s and 356s, while beams are typically 254s up to 1056s. Larger grids have been erected inside the Centre's two main anchor stores, which are double-level retail units and required large open-plan areas. "Steel lends itself to these large open areas," Mr Dobbs says.

Above the basement level a large number of plate girders were required to provide a clear span over the loading bays and truck maneuvering areas, and again at level 4 where the multi-storey car park spanned across the east-west mall, which was required by the architects to be column free. Rowen erected nearly 2,000t of these plate girders to act as transfer beams.

"Holding up the basement roof are some of the project's biggest steel members," Mr Dobbs explains. These girders are 30m-long and weigh close to 40t, and were brought to site in one piece from Rowen's fabrication yard 20 miles away in Nottinghamshire.

These weren't the only large girders utilised on-site. There are a total of 11 steel access bridges connecting the car park's different levels, and these each required two 25m-long girders which were erected 7.5m apart and then in-filled with steel crossbeams and a concrete slab.

Vehicular access from the street to the multi-storey car park lower level - which is the Centre's fourth storey - is provided by two means. One is a steel-framed helical express ramp off London Road that had a complex geometry requiring beams to be curved in two directions.

"Once we'd produced the first set of members the whole ramp just repeats itself along its entire length," Mr Dobbs says.

The second access is via a new steel box girder bridge erected across London Road. For aesthetic reasons a central spine trapezoidal steel box girder was selected with tapered steel crossbeams cantilevering off on each side and supporting a

"Normally you'd construct a building from one end to the other, but on this project we've had to work around the existing building."

Above: The new centre is fully integrated into the existing structure. Right: A complex grid pattern was erected to accommodate the mall's roof glazing.

stainless steel balustrade as well as the deck. "This was all assembled into one piece on the ground and erected in one continuous overnight operation as this was the only time the road was allowed to be closed by Derby City Council," Mr Crawford says.

The cinema complex, meanwhile, is basically a 50m x 100m steel-framed box which sits on top of the existing centre at level four. Again, for this part of the project MPN designed a grid of 20m span plate girders to support the cinema building over two malls. The addition of the cinema building late into the project meant that many of the existing columns and foundations of the existing centre had to be strengthened to support the new columns. In other locations, new steel columns had to be punched through the existing floor slabs to be supported on new foundations installed within the existing basement car park.

Logistically, working around an existing shopping centre which has remained open throughout the construction process has also presented many challenges. Westfield says it is currently renovating the existing centre to ensure the same high standard of design and materials run continuously throughout the malls, creating the impression of one major new shopping centre. However, above the existing ground floor shop units, which had to be kept trading throughout, Westfield is constructing a new foodcourt. "The new frame had to be

"The new frame had to be extremely lightweight in order not to overload the existing concrete columns and foundations within the stores"

extremely lightweight in order not to overload the existing concrete columns and foundations within the stores, which could not be accessed for strengthening. In addition, large spans were required by the architect, with few columns to create as flexible space as possible. So steel was the obvious solution," Mr Crawford says.

Four malls connect the new shopping centre's retail outlets in a rectangular grid pattern. Two run north to south, with a third new mall at the eastern end and the fourth sitting above the old structure's existing mall at the western end, which is currently being refurbished.

The new malls will have fully glazed roof lights. Constructing their roofs entailed erecting a complex grid pattern to provide support for the curved ceilings and bulkheads above the shop fronts. "More than 800 individual steel members were installed for each of the mall's roofs," Mr Dobbs explains. "There is only 100t of steel in each roof, but a lot of erecting was needed."

Being part of the large Severfield-Rowen group has obviously helped Rowen Structures do such a large project, with some of the steelwork being fabricated by Sevefield-Reeve and Atlas Ward Structures. Meanwhile, the steel erection was predominantly carried out by Steelcraft - another member of the Severfield group.

"We used Steelcraft's mobile cranes up to the project's fourth level," Mr Dobbs says. "These units couldn't get the required radius from there on up, so we then utilised Westfield's five tower cranes for steel erection of the upper floors."

The new and enlarged Westfield Shopping Centre is due to open for business by the end of 2007, meaning Derby will be at the forefront of retailing in the East Midlands just in time for Xmas.

Above: One of the two anchor stores, Marks & Spencer. Left: Access to the site has been a major challenge.

Cairnhill cracks the egg

The new council headquarters extension at Paisley incorporates an unusual and complex egg-shaped steel debating chamber.

Constructing extensions to existing structures can take many forms, with the most popular being to tie in something similar to the original design. However, Renfrewshire Council has taken a slightly different approach for its headquarters extension in Paisley.

The building is steel-framed and attached to an older concrete building via three steel pedestrian bridges with the entire structure sitting on top of a concrete multi-storey carpark. It has five storeys and is a uniform 36m-long x 7m wide reaching an overall height of 16m.

Adding to the office space there is also, attached to the west elevation, a Customer Services annex which has a footprint of 32m x 29m and is a two-level building incorporating a mezzanine level.

It is this annex which contains the most distinctive and complex part of the scheme. Inside there is an egg-shaped debating chamber which is supported on six 250 x 250 x 10 SHS columns - giving it a floating effect - and attaches to the main building at second floor level.

"Every one of the 178 UB curved members used on the egg was unique."

The 'egg', however, will be visible from outside as the steel-framed Customer Services building which wraps-around it will have a glazed cladding.

Jack Sanderson, Managing Director of steelwork contractor Cairnhill Structures, says steel erection began in the Summer of 2005 and the 'Egg' required some intricate and complex design work.

"Every one of the 178 UB curved members used on the egg was unique," Mr Sanderson explains. Cairnhill used Barnshaw Section Benders to roll these members and, "this required some close cooperation," he explains.

Kenny Stevenson, Associate Director of structural engineers Struer, agrees and says the 3D modelling of the 'Egg' was possibly the most challenging aspect of the project. "There were so many differing members," he says.

The 'Egg' steelwork also consists of 533 UB main floor supports, 457 UB elliptical perimeter beams and 254 floor tie members. Its overall dimensions are 19m long, 13m wide and 9m tall, including the supporting legs. Once the steelwork is complete the 'Egg' will be clad in copper.

Space was at a premium on the site, which is why the structure utlises the top floor of the car park. "Using steel also meant less plant and equipment on an already tight site," adds Mr Sanderson. As there was little space for materials to be stored at ground level all steel had to be immediately lifted up to the car park roof once it was delivered.

Building on top of the existing car park also meant the lower structure had to be fully surveyed to make sure it could actually carry the extra load.

Mr Stevenson says there was originally a landscaped area on the roof and consequently the car park was designed to carry an extra loading.

"However, the new council building is constructed on top of a steel transfer structure that takes the extra loads down into the existing concrete columns, which have also been strengthened with steel angles," Mr Stevenson explains. The transfer frame sits within the raised floor which was originally the car park roof.

Steelwork on the building is now complete, and the main contractor is finishing fit-out. The headquarters extension is expected to be fully occupied by November 2007.

FACT FILE
Renfrewshire Council, Paisley Headquarters extension
Main client: *Renfrewshire Council*
Architect: *Cooper Cromar*
Structural engineer: *Struer*
Main contractor: *Amec*
Steelwork contractor: *Cairnhill Structures*
Steel tonnage: *250t*

Town centre transformed with steelwork

So successfully was steel used for the redevelopment of Workington town centre, the contract was extended to include an adjacent multi-storey car park.

FACT FILE
Washington Square, Workington, Cumbria
Main client: *Harrison Developments*
Architect: *CDA*
Structural engineer: *Ward Cole*
Main contractor: *Thomas Armstrong Construction*
Steelwork contractor: *Conder Structures*
Project value: *£45M*
Steel tonnage: *2,020t*

The centre of Workington until recently comprised an uninspiring mixture of run-down Victorian streets and shops with a smattering of 1960s developments. But a £45M redevelopment project has replaced many of these buildings with a new piazza-style shopping centre, based around a Debenhams anchor store and a new multi-storey car park.

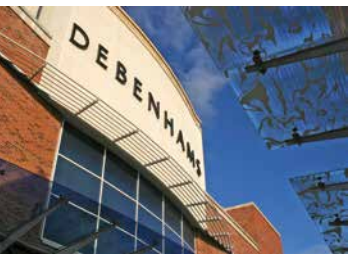
More than 2,000t of structural steelwork has been erected by Conder Structures in two projects to complete the redevelopment of Workington's town centre to form the new Washington Square complex.

The construction of the new development is in a cruciform pattern of pedestrian shopping around four 'zones', with new shops built over the former surface car park to fill gaps in the existing layout of the town centre.

Gordon Ridley, Conder Structures Managing Director, says steelwork has reconfigured the town centre into 25,640m^2 of good quality shopping in 50 units occupied by household brand names including Next, New Look, H Samuel, Body Shop and Thomas Cook as well as regional and local retailers.

Zone One of the project, which was the last phase to get started, has a footprint of 75m x 47m and consists of a three level 427-space multi-storey car park sitting on top of one level of retail outlets. Tim Bunker, Quantity Surveyor for main contractor Thomas Armstrong says this part of development could have been built in concrete.

"Both steel and concrete were considered in the original tender. But this Zone was the last to begin and steel had already been used on the other zones very successfully," Mr Bunker says.



"The use of steel for the car park required intensive work by Conder, but they were up to the task for this intricate and difficult design. The advantages of quicker erection on the limited site have been confirmed," Mr Bunker adds.

According to Thomas Armstrong, the steel structured car park was actually 8%-10% cheaper than the proposed concrete alternative and offered significant advantages in faster erection on the limited site.

"The car park is surrounded on three sides by retail developments and a challenging aspect of the job was actually getting the required number of car spaces into the confined footprint," Mr Bunker adds. In order to maintain the overall plan and remain within the proposed height and elevations of the new town centre, Mr Ridley says Conder built the car park using its special beam construction with curved elements or frames with falls in the car park of 1:50, plus shallow ramped entrances and exits.

The structure falls within an overall height of 13m to the top of the parapet and still offers more than 400 spaces.

The structure falls within an overall height of 13m to the top of the parapet and still offers more than 400 spaces – an increase of 50% in the number of parking spaces available in the town. The company erected more than 700t of steelwork to complete the car park structure.

In the car park the largest columns were 11m long 356 x 368 x 129 UCs, with the largest beams

being 762 x 267 x 197 beams located on the perimeter and in the middle of the structure.

Using steel instead of concrete also helped keep congestion to minimum on the confined site and surrounding area. "By using steel we had less deliveries and less equipment," Mr Bunker explains.

The 'flagship' of the overall development is the £6M 8,450m^2 Debenhams anchor store, which is built over three levels and takes up most of project's Zone Three.

In the retail part of the project the largest steelwork members were used in Debenhams, with 16.3m long 356 x 368 x 129 columns on the perimeter of the store and the largest internal columns being 9.5m long 686 x 254 x 140 beams.

"This is the biggest retail unit in the scheme and also required the largest spans," Wayne Hansard, Structural Engineer for Ward Cole says. "Debenhams requested a 10.8m x 10.2m grid throughout the store for their open-plan floor layout," he adds.

The anchor store has a braced steel-framed which acts compositely throughout with the steel beams.

Adjoining the anchor store are Zones Two and Four which are both retail areas of two-level units arranged along two malls with a service road. The major difference in the levels of the two roads has been exploited to provide delivery bays to the retail outlets on ground level with levels 2 and 3 of the car park placed above the shops. The finished floor level at the 3rd level is 26.83m with minimum clearance of 2.2m between floors and floor-to-floor heights of 3.13m.

The architect's design breaks up the elevations into individual buildings by the use of different materials and roof profiles to create a 'streetscape' that matches the rest of the town centre. Glass canopies provide protection for shoppers from the weather, while to enhance a local flavour, all malls and surrounding roads have been named after local sportsmen and woman.

Zone Four has also involved a major refurbishment of some existing shops and these structures have been extended with new steel frames, explains Mr Hansard.

The entire project has now been completed and the final piece in the jig-saw - the car park - opens for business in early November.

Top left and above: The multi-storey car park was cheaper than a concrete structure. Below: The new shopping mall and streets have been designed around their differing levels to incorporate delivery ramps.

Making it work for you: NEC3 the engineering and construction subcontract

The NEC3 subcontract form is potentially a very effective tool for securing successful projects, says Marion Rich, Legal and Contractual Affairs Director of the BCSA, in this review.

Now in its third edition (NEC3), the Engineering and Construction Contract was first published in 1991 under the name New Engineering Contract. It is radically different from traditional construction contracts and as such has been both praised and criticised - the writer's experience is that those who work with it like it a lot; many lawyers do not.

Recently, the contract has taken on even more importance: in July of this year, the Olympic Delivery Authority announced that it had chosen NEC3 suite of contracts to procure all fixed assets and infrastructure for the Games.

The speakers gathered to run the seminar were outstanding in the breadth and depth of their knowledge: in the chair was Professor Rudi Klein, well known for his trenchant articles in the trade press and - along with other duties - Chairman of the NEC Users' Group. Also speaking were: Robert Gerrard, ex-Chairman of the Users' Group and now secretary of it; Paul Morrison, Commercial Director of Conder Structures Ltd; Simon Boyd, Contracts Director of John Reid & Sons (Strucsteel) Ltd and James Davison, part of the legal support team of Cyril Sweett, the construction consultant.

Many thanks are due to the speakers, on whose presentations the writer has drawn extensively in the preparation of this article. In this article, the subcontract is referred to as ECS and the family of forms in general as NEC.

So what is NEC?

Well, one thing NEC is not is a construction contract that can be put in a drawer and forgotten about. This suite of contracts does far more than merely define legal relationships: instead, it can be seen as implementing sound project management principles. It works best to think of it as a management tool within a legal framework.

It works best to think of it as a management tool within a legal framework.

NEC contracts are modular in format in that there are a number of core clauses with a selection of bolt-on Options – both Main Options and Secondary Options. Main Options deal with different pricing options that change the balance of financial risk between the parties (in ECS, priced subcontract with activity schedule, priced subcontract with bill of quantities, target subcontract with activity schedule, target subcontract with bill of quantities, cost reimbursable).

There are two other Main Options, dealing with dispute resolution – one is for use if the 'Construction Act' applies (i.e., within the UK), one where it does not (outside the UK).

There is no standalone form for design and build work, but NEC works with either traditional engineer-led procurement or with D&B.

Secondary Options deal with a number of variables and as many as required can be chosen for each project.

NEC itself is not a partnering contract although it does encourage collaborative working. One of the options, Option X12 is a partnering option and if that appears in ECS, it makes the subcontractor part of the project team.

The NEC family of contracts is famous for its obligation to work 'in a spirit of mutual trust and cooperation'

The NEC family of contracts is famous for its obligation to work 'in a spirit of mutual trust and cooperation': Robert Gerrard defines this as meaning, in effect, tell the truth and be cooperative.

NEC genuinely aims at clarity and flexibility. It claims to have no cross-references but you might find you still need to have a finger in several pages as you are reading it!

A number of public sector clients already use NEC. One persistent problem, however, is that what happens at main contract level does

not always get accurately translated down the chain: outdated methods of working get in the way and prompt page after page of amendments that simply pass all the risk on to the next party. Everyone – from the client down – needs to make sure that this does not happen. Risk is dealt with in a carefully balanced way in NEC and it does no-one any good to tamper with it to such a great extent. Additional conditions (the infamous Z clauses) should be used sparingly where genuinely required by the project.

Guidance Notes, Flow Charts and a guide for users all provide invaluable support for the user.

Key Characteristics

The key characteristics of the ECS are:

- Subcontract Works Information
  The Works Information specifies and describes the subcontract works and states any constraints on how the Subcontractor works. It is absolutely vital to getting the contract right.

- Early Warning
  This provides that the Contractor and Subcontractor have a duty to notify each other if either becomes aware of a matter which could increase the price, delay completion or the meeting of a key date or impair the performance in use of the subcontract works. The Early Warning system can be regarded as the 'jewel in the crown' of NEC, buying time to deal with problems as early as possible in the interest of the project. Its purpose is not to shift the burden of liability from one party to another.

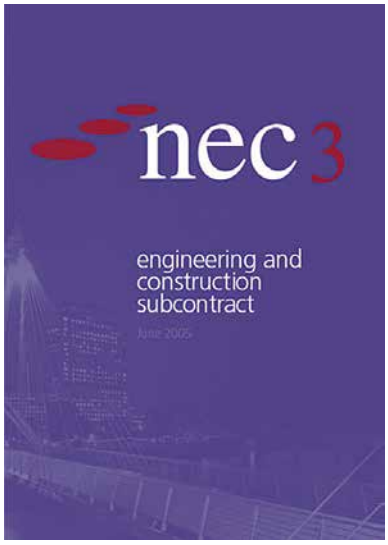
- Time Control
  In NEC, the programme is a living document to be kept under review and updated. For each problem or issue, it asks the question, 'what effect will this have on the project?' The programme thus becomes an essential management tool.

- Compensation Events
  Unlike many contracts, NEC deals with time and cost events in one process. Ascertaining loss and expense in advance may be difficult but, again, the contract is promoting real time project management.

- Risk Register
  This is the Contractor's and Subcontractor's opportunity to let the other party know what risk factors will affect their work. It is thus of paramount importance. Again, it is a living document and will be updated as and when necessary as part of the Early Warning System.

Subcontract Data Part II

This part of the ECS deals with data provided by the Subcontractor: it is vital for this to be completed correctly and comprehensively if the specialist is to realise the full benefits of the form



and so requires serious thought to ensure that the particular circumstances of each specialist are properly set out.

Pitfalls

It is perhaps unfair to refer to pitfalls but NEC3 has a different way of doing things and it is vital to get to grips with the contract – read it and then read it again, the core clauses are not very long. This might seem like a lot of work but there are rewards to be won for using the contract correctly. In every aspect of the contract, it is important to ensure that the procedures and philosophy behind NEC3 are understood.

Getting the best from NEC depends greatly on investing the time and effort at the very beginning to ensure that all documents are correctly completed. It is a very administrative and process based contract with consequences for failure to follow the procedure. Matters cannot be left: it is important to notify the other party of any issue early. This enables the other party, if it wishes, to disagree: then the problem can either be solved or a swift visit arranged to an adjudicator.

Getting the best from NEC depends greatly on investing the time and effort at the very beginning to ensure that all documents are correctly completed.

Conclusion

All these things really direct the user of ECS to one conclusion: the key is to be clear, transparent and upfront. The contract is a deliberate attempt to promote good, clear, open project management and to seek swift solutions to problems.

Provided ECS is set up properly and implemented properly, there is no doubt it is an excellent management tool that will be invaluable in producing a good result – for both the project and the parties.

Steel Construction and Thermal Bridging

Thermal bridging has become more of an issue following the introduction of the latest revision of Part L of the Building Regulations for England and Wales in April this year. Christopher Kendrick, Consultant to the SCI, examines the issues.

Thermal bridging refers to the additional heat loss from a building as a result of either geometry (for example at corners) or components of relatively high thermal conductivity (such as fixings and other structural elements) penetrating the insulated envelope. This additional heat flow must be added to the plane heat loss accounted for in the U-value to give a true measure of actual fabric heat loss.

1. HEAT LOSS

Both SAP 2005 and SBEM, the energy models, for domestic and non-domestic construction respectively, used to demonstrate Part L energy performance compliance, require thermal bridging heat losses to be included in the calculation. Repeating thermal bridges, such as frame elements, are included in the U-value, but non-repeating thermal bridges such as floor junctions, window and door junctions, eaves, verge and ridges form additional heat transfer paths. These can be accounted for by linear thermal transmission factors, ψ (known as psi values), measured in W/m.K for each thermal bridge. Total fabric conduction heat loss per Kelvin temperature difference is then given by:

$$\psi.L + \Sigma U.A$$

Where ψ is the linear thermal transmission coefficient (W/m.K)
L is the length of that thermal bridge (m)
U is the U-value of an element (W/m^2K)
A is the area of that element (m^2)

1.1 Domestic buildings

Accredited Construction Details (ACD's) for domestic construction, are available as .pdf documents from the internet(1) for many different types of feature which, if followed, enable designers to minimize thermal bridging. If Ψs not calculated explicitly for each thermal bridge, approximation factors may be used. For example in Appendix K of SAP 2005(2), thermal bridging heat loss HTB is assumed to be:

$$HTB = y.\ \Sigma A_{exp}$$

Where ΣA_{exp} is the overall exposed area of the building envelope y is a factor, either:
y = 0.08 (Accredited Construction Details used)
y = 0.15 (other details used)

Thermal bridging can thus add significantly to the overall fabric heat loss.

1.2 Non- domestic buildings

For building systems such as composite and built-up steel cladding, manufacturers can usually provide ψ values. Standard values are included in SBEM for metal cladding systems based on MCRMA details. However, for larger projects, it can be economic to calculate the thermal bridge losses separately for each detail. This is done by using two- and three-dimensional conduction analysis software, often working from the CAD drawings of details.

2. CONDENSATION

Although heat loss is a very important effect of thermal bridging, the more serious aspect as far as building occupiers are concerned arises from the low internal surface temperatures around the thermal bridge, which can lead to surface condensation. For non-absorbent surfaces such as steel, condensation can cause unsightly collection of moisture and dripping/pooling on surfaces beneath. For surrounding absorbent materials such as insulation products or plasterboard, interstitial condensation can occur, leading to loss of thermal performance, loss of structural integrity and mould growth. The local relative humidity need only be sustained at above 80% for mould growth to accelerate. Mould, as well as being unsightly, gives off spores that can cause bronchial problems and aggravates existing asthmatic conditions.

An indicator of condensation risk is provided by the temperature factor f_{Rsi}, a factor given by:

$$f_{Rsi} = \frac{t_{si} - t_{ao}}{t_{ai} - t_{ao}}$$

where t_{si} is internal surface temperature
t_{ao} is external air temperature
t_{ai} is internal air temperature

Minimum recommended values of f_{Rsi} depend upon the use of the building and its consequent internal relative humidity. For a dwelling, where cooking and washing can cause high humidity, a mandatory minimum of f_{Rsi} = 0.75 is stipulated. For swimming pools, a value of 0.9 is recommended, whereas for commercial buildings a value of 0.5 is allowable.

For more information, refer to the BRE Information Paper BRE 1/06 (3).

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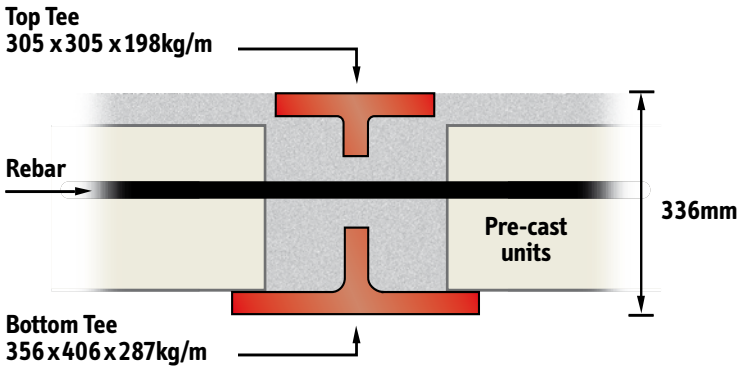

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Figure 1: Typical apartment block used for thermal modeling

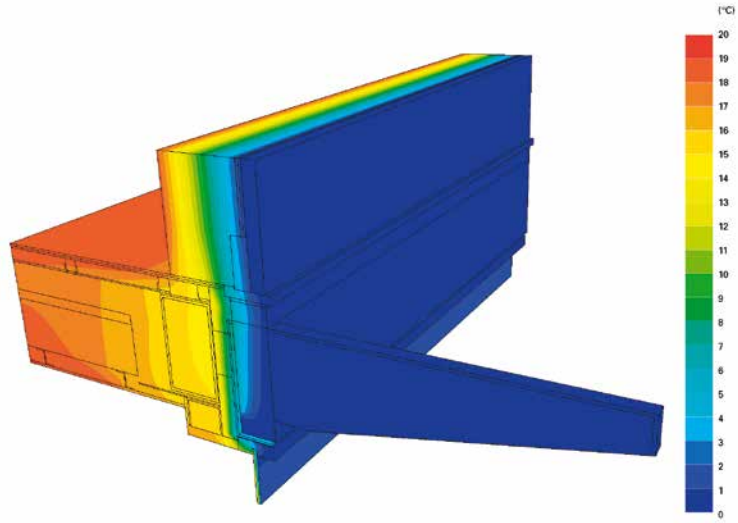

Figure 2: Cantilever balcony thermal modeled

3. MINIMISING THERMAL BRIDGING IN STEEL CONSTRUCTION

Steel has a relatively high thermal conductivity and therefore details need careful consideration. However, there are effective methods for incorporating steel components without causing unduly high heat loss or condensation risk.

Addition of local insulation, for example around beam elements that penetrate a wall, such as to support a roof overhang or canopy. Beams can be boxed in on the outside portion to a specified length and insulated with mineral wool. Provision of thermal breaks. Examples include composite cladding where the steel skin is separated at junctions by a layer of insulation and use of thermal pads beneath brackets in built-up cladding systems.

Slotted steel can significantly reduce thermal transfer. Overlapping lines of slots can reduce the equivalent thermal conductivity of light gauge steel studs by a factor of ten or more, and are also used with steel box-section lintels.

Lower conductivity fixings such as stainless steel bolts or screws with a thermal conductivity less than a third that of steel can be used and can have a positive effect.

Proprietary products currently on the market in the UK, constructed from insulation and stainless steel, which connect (for example) steel beams that penetrate the insulated envelope of a building.

Studies by SCI in conjunction with Oxford Brookes University have demonstrated that current practices can meet the Part L requirements. A multi-storey residential building example with Slimdek floors and steel cantilevered balconies was chosen to illustrate the effects of the three SAP options for calculating thermal bridge heat loss. See Figure 1.

	Top floor corner (1)	*Mid-floor corner (2)*	*Mid-façade (3)*
Target Emissions Rate*	23.530	20.650	19.650
Option 1: (H_{tb} = 0.08A)			
Dwelling Emissions Rate	21.420	18.550	17.640
SAP Rating	82.000	85.000	85.000
Option 2: (H_{tb} = 0.15A)			
Dwelling Emissions Rate	22.760	18.990	18.100
SAP Rating	83.000	85.000	85.000
Option 3: (calculated H_{tb})			
Dwelling Emissions Rate	21.810	19.030	18.340
SAP Rating	83.000	85.000	85.000

Table 1. Carbon dioxide Emission Rate (kg $CO_2/m^2/yr$)*

Linear thermal transmission (ψ) was calculated for all thermal bridges using BISCO and TRISCO software. See Figure 2. These values were then multiplied by the length of each thermal bridge to give a total value for thermal bridging (H_{tb}) for three types of apartment. Results in Table 1 show that the design can pass SAP by using the allowed approximation for non-accredited construction details, and there is no need to calculate linear thermal bridging separately in this case.

4. CONCLUSIONS

Thermal bridging can be minimized in steel construction by good design practices, perhaps utilizing thermal modeling techniques as demonstrated in this article, specifying the correct materials in the correct locations, and with application of products currently on the market in the UK. Regardless of regulations, all building designers have a responsibility to produce buildings that are both energy efficient and not prone to problems caused by condensation on internal surfaces.

REFERENCES

http://www.planningportal.gov.uk/england/professionals/en/1115314255954.html
The Government's Standard Assessment Procedure for Energy Rating of Dwellings, BRE 2005
Ward T, Assessing the effects of thermal bridging at junctions and around openings, BRE IP1/06, Building Research Establishment 2006

LATERAL TORSIONAL BUCKLING AND SLENDERNESS – ERRATUM

Mary Brettle, SCI

In the October 2006 edition of the NSC the technical article on Lateral torsional buckling and slenderness contained the following errors.

Section 3 pages 32 and 34 –
all the λ_{LT} in the text for Eurocode 3 should be $\overline{\lambda}_{LT}$.

Section 3.2 page 34 – the equation for $\overline{\lambda}_{LT}$ should be replaced by the following equation:

$$\overline{\lambda}_{LT} = \frac{1}{\sqrt{C_1}} 0.9 \overline{\lambda}_z \sqrt{\beta_W}$$

The following equation should be added above the definition for W_y

$$\beta_w = \frac{W_y}{W_{pl,y}}$$

Steel Construction Books

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BCSA

NEW

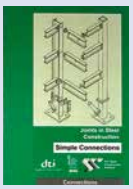
Code of Practice for Erection of Multi-Storey Buildings

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

STEEL DETAILING - The Magenta Book*

Steel Details

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



CONNECTING - The Green Book*

Joints in Steel Construction: Simple Connections

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

STEEL BUILDINGS - The Silver Book

Steel Buildings

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

ASSESSING - The Brown Book

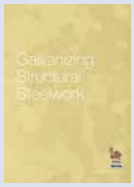
Historical Structural Steelwork Handbook

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

SPECIFYING - The Black Book

National Structural Steelwork Specification

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



GALVANIZING - The Beige Book

Galvanizing Structural Steelwork

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

DESIGNING - The Red Book

The Handbook of Structural Steelwork

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

SPECIFYING - The Grey Book

Commentary on the National Structural Steelwork Specification

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

BRIDGES - The Purple Book

Steel Bridges

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

Code of Practice for Erection of Low Rise Buildings

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

Code of Practice for Metal Decking & Stud Welding

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

Guide to the Erection of Steel Bridges

All aspects in the planning and implementation of the safe erection of a steel bridge so that personnel in the whole team will benefit from a better understanding of the erection process. The guide is complementary to the publication Steel Bridges.

Guide to Steel Erection in Windy Conditions

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

Health and Safety in the Office

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

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

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

Health and Safety On Site

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

Health and Safety: a Pocket Guide for Managers and Supervisors

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

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

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NOVEMBER

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

01: Preparation for Eurocodes
Preparation for engineers in the use of Eurocode 3 covering the documentation needed for design, the design principles for steel and the major changes to present practice.
location: Cambridge
cost: SCI Member £220 + VAT; Non Member £280 + VAT
contact: Education@steel-sci.com

07: Welding for engineers
This course explains the processes and practicalities of welding, the importance of welding procedures and requirements for weld testing.
location: Dublin
cost: SCI Member £220 + VAT (€360)
Non Member £280 + VAT (€400)
contact: Education@steel-sci.com

08: Fire engineering workshop
These courses are centred on how to design steel buildings to achieve 30 minutes' fire resistance without applied fire protection and how to use the new Cardington fire guidance to eliminate fire protection off secondary beams. The course is based on formal discussions and worked examples. The all-day workshop also incudes the use of a computer model for frame analysis.
location: Birmingham
cost: Free (limited places)

14: Composite Design
Combining steel and concrete so that they act together structurally in composite elements can lead to very efficient frame solutions. This course will cover the design of various composite elements (beams, slabs and connections) with reference to the current British Standards for composite construction (BS 5950: Parts 3 and 4).
location: Glasgow
cost: SCI Member £220 + VAT. Non Member £280 + VAT
contact: Education@steel-sci.com

15: Overview of new European standards for steel construction
www.steelconstruction.org
The aim of this seminar is to prepare engineers for the introduction of the forthcoming European steel standards that will be introduced over the next few years. The seminar gives a general overview of the Eurocodes with more in-depth presentations of the loading (EN 1990 and EN 1991) and the steel design standard, Eurocode 3. The seminar also covers the new execution standard for steel structures; BS EN 1090-2, which will eventually replace BS 5950-2, and an overview of CE Marking and the harmonised standard for fabricated steelwork.
location: Glasgow
cost: Member £60.00 + VAT, Non Member £80.00 + VAT
contact: gillian.mitchell@steelconstruction.org

15: Preparation for Eurocodes
For full details see 1 November
location: Manchester
cost: SCI Member £220 + VAT, Non Member £280 + VAT
contact: Education@steel-sci.com

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

21: Floor Vibrations
Explaining the theory of dynamic floor response and its application to composite and non-composite steelwork floor systems and learning how to apply the procedures to calculate the all-important response factors.
location: Bristol
cost: SCI Member £220 + VAT. Non Member £280 + VAT
contact: Education@steel-sci.com

21: Welding for engineers
For full details see 7 November
Location: Birmingham
cost: SCI Member £220 + VAT (€360)
Non Member £280 + VAT (€400)
contact: Education@steel-sci.com

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

29: Acoustic Design in Steel
Acoustic design of buildings is an important consideration especially for multi-storey residential developments, hospitals and schools. This course will explain what the acoustic regulations require, the theory of acoustic detailing and how to satisfy the regulations and provide good acoustic performance in steel construction.
Location: Birmingham
Cost: SCI Member £220 + VAT. Non Member£280 + VAT
Contact: Education@steel-sci.com

NOVEMBER/DECEMBER

Aspects of Steel in Construction
Corus and the Steel Construction Institute are hosting a series of lectures on a range of topics relating to steel. The course will run over a period of 6 weeks commencing 26 October. Each evening will consist of two one-hour lectures, presented by speakers from Corus and the SCI, giving attendees an overview of various aspects of steel in construction. The full course represents 12 hours or 2 days of CPD and will be held at the locations below.
location: Leeds, Cardiff, Dublin
cost: £149 + VAT
contact: Education@steel-sci.com

DECEMBER

06: Overview of new European standards for steel construction
www.steelconstruction.org
For full details see 15 November
location: Belfast
cost: Member £60.00 + VAT, Non Member £80.00 + VAT
contact: gillian.mitchell@steelconstruction.org

15: Steel: The Show
For full details see 1 November
location: London. cost: free

CONTACTS

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Visit: www.corusevents.com or telephone: (01724) 405060
or email: events@corusgroup.com

Organised by **The Steel Construction Institute**
Visit: www.steel-sci.org/courses or telephone: (01344) 636500

Organised by **The British ConstructionalSteelwork Association**
Contact: see individual event details

The SCI Annual Dinner

16th November 2006

The Landmark London,
222 Marylebone Road, London NW1 6JQ




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

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

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

Dress Code: Black Tie

For further details contact • Liz Chamberlain • SCI • Tel: +44(0)1344 636525
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40 Years Ago in

Building with Steel

New approach to school design

Thomas McKean High School, Wilmington

Steelwork for nine of the eleven pods nearing completion

Because of its unusual honeycomb design this steel framed school is one of the most interesting educational buildings in the USA. The design resulted in considerable economies because it involved a minimum variety of materials, permitted maximum shop fabrication and both simplified and speeded erection.

The academic area of the building is divided in 11 hexagonal cells or 'pods' which are fitted together to form a vast honeycomb structure. Each pod consists of six rooms equally spaced around a centre room accessible to the six perimeter rooms.

The entire academic area of the school is supported on steel columns, a feature which makes possible a completely flexible arrangement of partitions. The columns consist of about 100 tons of cold-rolled hollow sections. Because of their very smooth finish most of the columns have been left exposed inside of the building, finished with a single coat of paint.

Dividing or interior room partitions are moveable steel panels providing flexibility of layout. In addition to the hollow sections about 450 tons of structural steel were used in the building.

New and Revised Codes and Standards

(from BSI Updates September 2006)

BS EN PUBLICATIONS

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

BS EN 10083:-
Steels for quenching and tempering
BS EN 10083-1:2006
General technical delivery conditions
Supersedes BS EN 10083-1:1991

AMENDMENTS TO BRITISH STANDARDS

BS 5950:-
Structural use of steelwork in building
BS 5950-5:1998
Code of practice for design of cold formed thin gauge sections
AMENDMENT 1 AMD 16502

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT

BS EN 10025:-
Hot rolled products of structural steels
BS EN 10025-4:2004/Corrigendum
Technical delivery conditions for thermomechanical rolled weldable fine grain structural steels

BS EN 10163:-
Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections
BS EN 10163-1:2004/Corrigendum
General requirements

ISO PUBLICATIONS

ISO 14343:-
Welding consumables. Wire electrodes, wires and rods for arc welding of stainless and heat resisting steels. Classification. Addition of strip electrodes for submerged arc welding and electroslag welding
AMENDMENT 1 March 2006 to ISO 1434:2002
Will not be implemented as a British Standard

ISO 17660:-
Welding. Welding of reinforcing steel
ISO 17660-1:2006
Load bearing welded joints
Will be implemented as an identical British Standard
ISO 17660-2:2006
Non-load bearing welded joints
Will be implemented as an identical British Standard

AD 305
Stiffness and Rotation of Moment Connections

The issue of connection stiffness and rotation for bolted end-plate moment connections arose recently at a connection workshop and concerned the stiffness of a cantilever bracket connection up to ultimate limit state.

Connection stiffness and rotation are very well covered in the opening chapters of *Joints in Steel Construction: Moment Connections, (SCI-P- 207)* which should be consulted for a full treatment of the issues, particularly section 2.5. Section 2.5 offers guidance as to the importance of connection stiffness in relation to various types of structure. Figure 1 shows typical cantilever bracket connection details.

When an infinitely rigid joint carries load its members and connection rotate as shown in figure 1a. The members at a theoretically rigid joint remain at the same angle to one another after the application of load. However, when the connections in a frame are not fully rigid an additional rotation Ø between the members also occurs, as shown in Figure 1b. This additional rotation is plotted in moment rotation curves for the classification of connections. Ø would be zero for a fully rigid connection, but this will not be achieved in practice. In some cases, the additional rotation and resulting frame deflections due to Ø must be accounted for and section 2.5 of *SCI-P-207* offers advice.

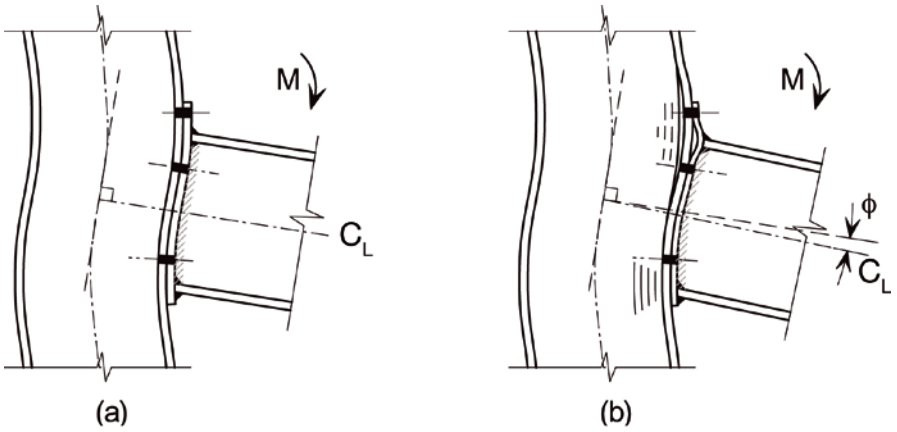

Figure 1: Typical Cantilever Bracket Details

Figure 2 is taken from *SCI-P- 207* and shows the 3 possible failure modes that may occur in a bolted end plate moment connection. The traditional British approach (Section 2.5, *SCI-P- 207*) to achieving steelwork connections that are designed to be fully rigid up to ultimate limit state is to ensure that Mode 3 is the critical mode of failure for the connection. In simple terms, mode 3 is bolt failure and is usually achieved by making the end plate thickness not less than the bolt diameter on the beam side. The welds, webs, flanges and end plates etc are designed to carry forces at least equal to the bolt capacities, ensuring that the bolts are the weakest link. On the column side of the connection suitable tension, compression and shear stiffeners may have to be added to ensure that the bolts are the weakest link. If both the beam end plate and column flange thicknesses are greater than the bolt diameter, the normal plastic bolt row force distribution is modified to a linear distribution in accordance with step 1C of *SCI-P- 207* in determining the moment of resistance of the connection. Moreover, it is necessary to limit the column web panel shear to 80% of the column capacity or provide suitable stiffening if this is not possible.

According to *SCI-P-207* when the above provisions are complied with it may be assumed for design purposes that the connection is fully rigid and the effects of joint rotation are small enough to be ignored. Only in very special cases will it be necessary to account for the value of Ø in structural calculations.

Contact: Thomas Cosgrove
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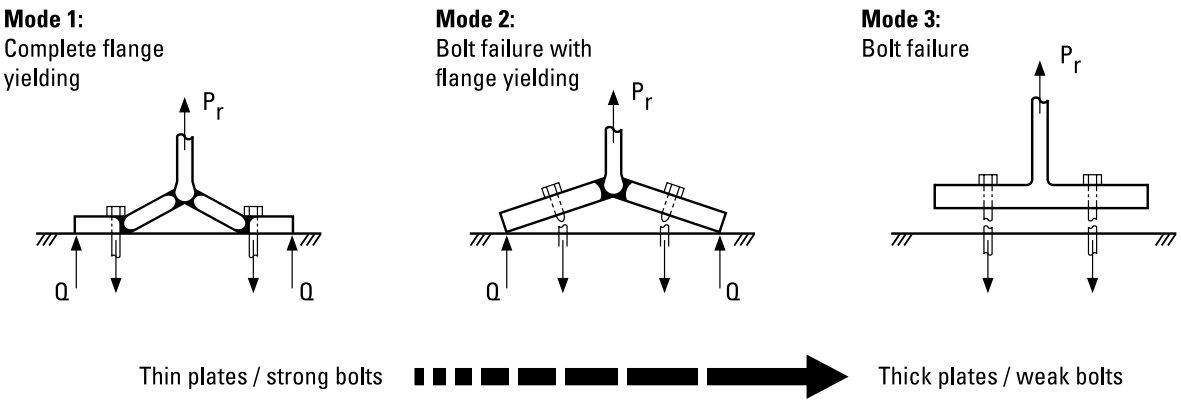

Figure 2 Failure Modes for Bolted End-plate Moment Connection

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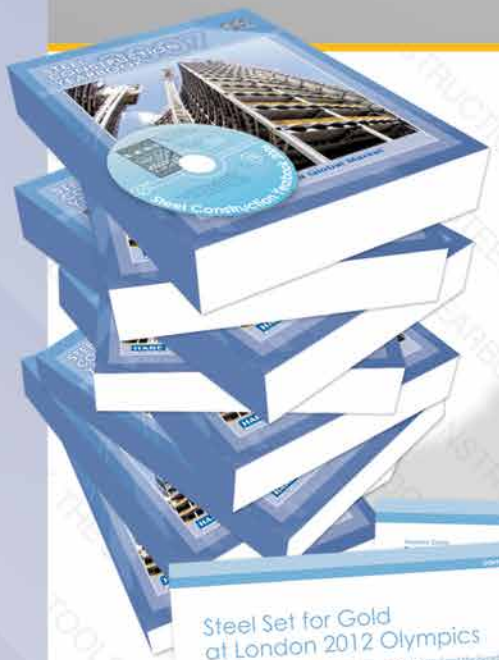

The 14th edition of the Steel Construction Yearbook and CD will be available in January 2007. Over 5000 copies will be distributed to the steel supply chain.

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

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

KEY

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

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

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

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

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

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Tel 01274 521444 **Fax** 01274 521130

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	●	●	●	●	●	●	●	●	●	●	●		●	Above £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
Brooksby Engineering	01707 872655					●		●	●	●	●				Up to £200,000
Butterley Ltd	01773 573573	●	●	●	●	●	●	●	●	●	●	●		●	Up to £3,000,000
Cairnhill Structures Ltd	01236 449393		●			●	●	●		●	●			●	Up to £1,400,000*
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 £6,000,000
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 £6,000,000
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
Normanby Wefco Ltd	01427 611000		●				●	●	●		●			●	Up to £800,000
Nusteel Structures Ltd	01303 268112						●	●	●	●				●	Up to £2,000,000*
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*
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*

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

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SCI

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- Information Technology
- Fire Engineering
- Light Steel and Modular Construction
- Offshore Hazard Engineering
- Offshore Structural Design
- Piling and Foundations
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- Steelwork Design
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Details of SCI Membership and services are available from:
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CSC (UK) Limited
Yeadon House, New Street, Pudsey, Leeds LS28 8AQ. England
tel ▶ +44 (0)113 239 3000 fax ▶ +44 (0)113 236 0546
e-mail ▶ sales@cscworld.com website ▶ www.cscworld.com