JANUARY 2010 VOL 18 NO 1

NSC

NEW STEEL CONSTRUCTION

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New London HQ for union

Eurocode design guides launched

Steel takes wing for 'Gulls

Belfast college is ship shape

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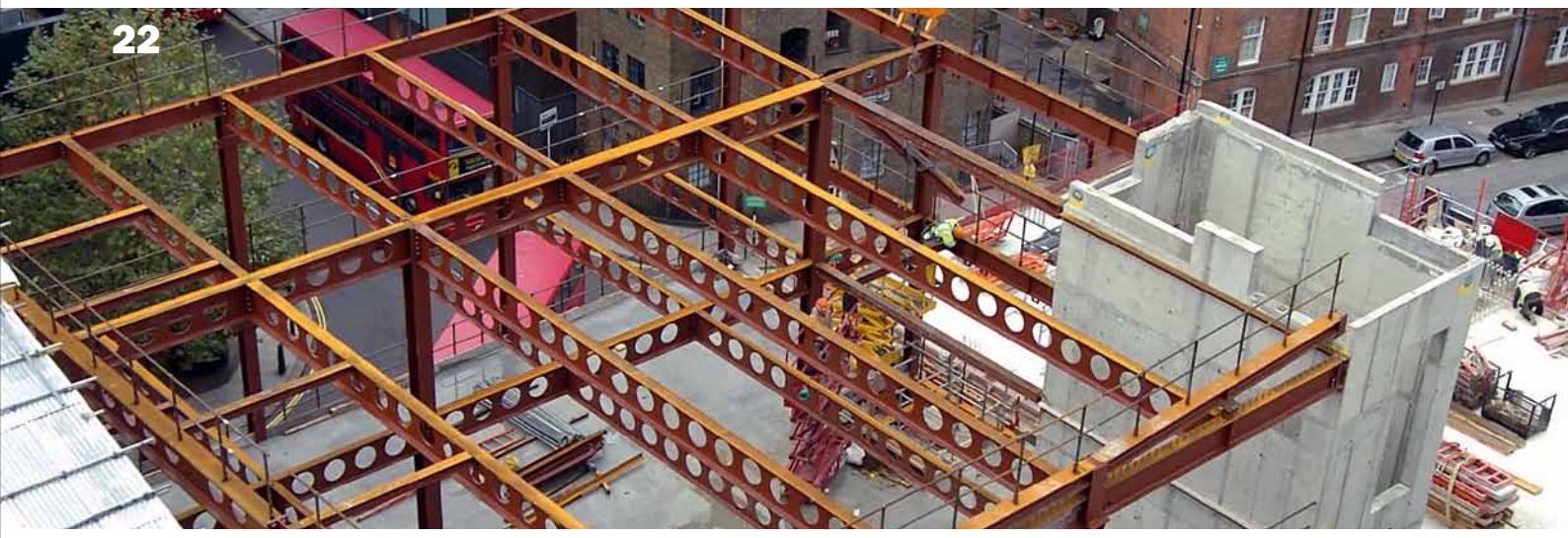

These and other steelwork articles can be downloaded from the New Steel Construction website at www.new-steel-construction.com

Cover Image
Unison headquarters, London
Main Client: Unison
Architect: Squire and Partners
Steelwork contractor: Graham Wood Structural
Steel tonnage: 600t

Cure the pain of a **tender** situation

How can Clients, Designers and Principal Contractors ensure that steelwork is done safely in accordance with the CDM Regulations?

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NSC NEW STEEL CONSTRUCTION
www.new-steel-construction.com

Steel a success since the 'swinging sixties'

A magazine's first issue of the new year is traditionally an occasion for looking forward, but we can be excused for a bit of a backward glance this year because the steel construction sector celebrates the fiftieth anniversary of publication in 1960 of its first regular magazine, then called Building With Steel.

Journalists relish the feeling when a first issue rolls off the press, with pride in what has been produced intermingled with nerves about how the new publication will be received by its target audience. That editorial staff of fifty years ago would no doubt be proud that the reception was good enough for the steel construction sector to still see the value in it fifty years on, so much so that publication frequency had increased from quarterly to monthly. Readers obviously continue to provide positive feedback to the steel sector's efforts to keep them abreast with progress on the latest projects, and advances in steel construction generally, that they get from New Steel Construction.

You can see some of the content of that first issue on page 36. There have been many changes in the industry since that first issue, when there was not a mention of sustainability for example. Since then we have quite rightly come to prioritise it to a massive extent, and to realise that steel has inherent sustainability benefits compared to other materials which has been delivered throughout the past 50 years, and before.

The era of post war austerity had only recently passed in 1960, meaning steel was widely available again for the first time in over 20 years. Steel had been a feature of large buildings, such as the Ritz Hotel, the first steel framed building in London which was built from 1904; however most steel was diverted to essential uses like ship and aircraft building during the two world wars.

A trend of falling prices in real terms for fabricated steelwork almost immediately got under way when steel was widely available, Building With Steel noted.

Clearly cost, then as now, was a key market driver and it is here that steel has made strides that might have read like sensationalist claims to those early writers on steel. Thanks to the Corus cost comparison studies that go back to the 1980's steel can demonstrate an unrivalled trend of real terms cost reductions.

The recent development of plastic theory meant lighter structures, the 1960 magazine noted, which has obviously been a great benefit to realising architectural visions and to realising client's demands for cost effective buildings and other structures.

Progress has been made on a very broad front since 1960, creating a steel construction sector that is the acknowledged world leader. The plans for the future of today's steel construction sector, including developing zero carbon solutions and Target Zero guides to sustainable design, would impress and surprise even the most visionary of those active 50 years ago.

Nick Barrett - Editor

Eurocodes support is ready

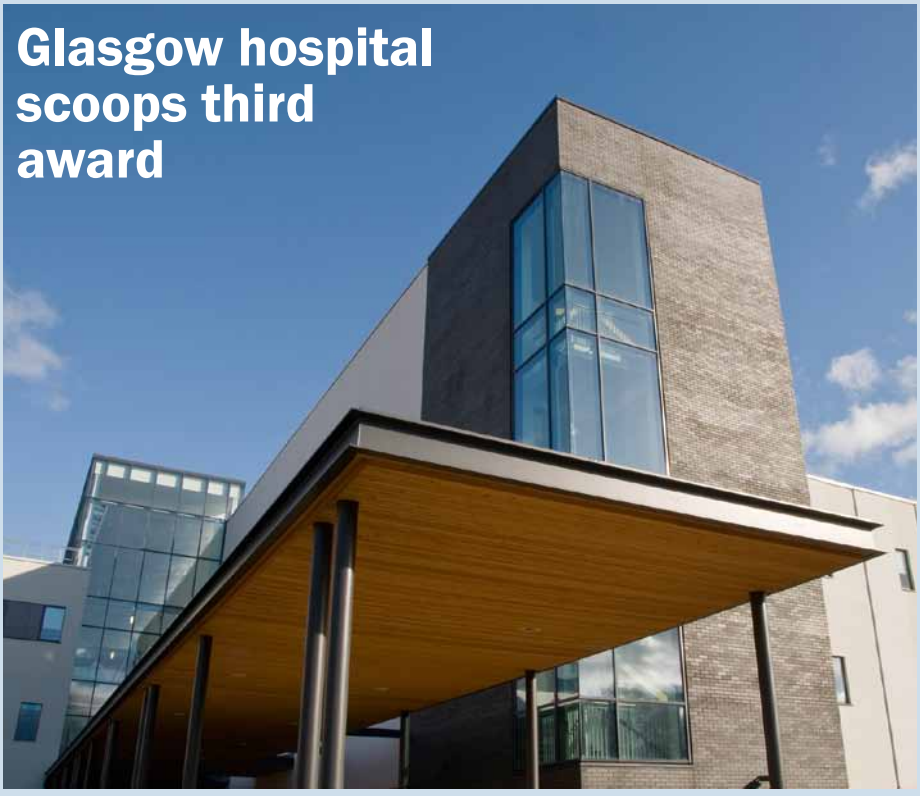
The steel construction sector declared itself ready for the introduction of the Eurocodes in March with the launch of the first guides to support steel designers making the changeover from British Standards (see page 24).

At the London launch event in November Chris Dolling of Corus said the introduction of Eurocodes was the most significant development ever for UK design codes. 'Designers need have no worries about using Eurocodes because although they are different from British Standards in several respects they are not more difficult to use. The steel construction sector has been involved in their development over many years so we have a depth of expertise that will be available to help designers with any aspects of Eurocodes.'

SCI Associate Director David Brown said the change over represented a manageable challenge. 'It is crucial that the national Annexes are studied and properly understood, but the biggest issue will be the lack of initial familiarity. Once the Eurocodes start to be used they will quickly become familiar and designers will start to see tangible benefits from their use.'

The British Constructional Steelwork Association's Dr David Moore told delegates at the launch event that the UK steel sector's chosen approach to supporting designers during the introduction of Eurocodes is different to that of other sector's:' The steel approach has been to develop resources that can to as great an extent as possible be used across Europe. We are also delivering these resources free of charge, as web based assets that will be continuously improved and developed.'

Glasgow hospital scoops third award



The new Stobhill Hospital in Glasgow has won the 'Best Healthcare Building 2009' at the Glasgow Institute of Architects (GIA) Awards, its third prestigious design award this year.

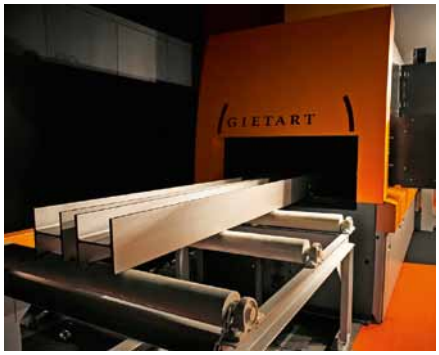
The state-of-the-art facility, which required 1,600t of structural steelwork for its main frame (see NSC Sept 2007), has also scooped the 'Best Designed Hospital 2009' at the Building Better Healthcare Awards, and the Roses Design Awards' 'Best Public Building' accolade.

Commenting on Stobhill the judges for the GIA Awards said they were impressed by the civilised approach to the new hospital - detailing has been honed to produce a calming space.

"The central circulation is clear bringing light deep in to the plan whilst the timber clad atriums provide warmth and light. Externally, the beautifully detailed canopies provide punctuations to a cultured facade."

Margaret Campbell, Commissioning Manager for the hospital, said: "We are delighted to have won a third award. It is well deserved recognition for all the hard work put in by the design team."

Kaltenbach acquires Dutch shotblasting and painting firm



Machinery manufacturer Kaltenbach has acquired through an asset deal, the production facility and brand of Gietart, the shotblasting and painting systems company based in Hengelo, the Netherlands.

Kaltenbach said the investment extends its capability as a systems provider for the processing of structural steel sections and plate, through direct control and supply of the brand leading range of Gietart.

Valentin Kaltenbach, Managing Director of the new company and Chief Executive Officer of the Kaltenbach Group, said: "We have formed a 100% daughter company trading as Kaltenbach Shotblast and Painting Systems, which became operational in November. There is a proven synergy between Kaltenbach and Gietart technologies, having been independently and successfully integrated for many years within installations worldwide."

Simon Smith, Managing Director of Kaltenbach UK, said: "This excellent opportunity will enable our customers to continue to benefit from Gietart products, with seamless ongoing sales, spares and service support."

Raising the roof for the Olympics

Construction work on London's 2012 Olympic site is firmly on track with the main venues already becoming landmarks on the east London skyline.

One of the most recent and visible achievements was the lifting and lowering into place of the wave-shaped Aquatics Centre roof (above), one of the most complex engineering and construction challenges of the entire Olympic site (see NSC May 2009).

The 160m long steel roof frame weighs more than 3,000t and rests on just three supports. It has been fabricated from plate rolled in Gateshead, Motherwell and Scunthorpe, assembled on the site and connected together 20m off the ground on temporary supports.

Raising the roof for the Aquatics Centre began in March 2009 when a 30m steel truss weighing more than 70t was lifted into place on top of the southern support wall. Over the following months another 10 steel trusses, each made up of four sections, were erected to connect the roof to the northern supports.

Once the steel frame was complete it was lifted over a metre at its southern end, turning on rotating joints in the northern roof supports. The top of the temporary trestles were removed and the roof frame lowered on to its three permanent supports.

Work has now begun on the aluminium roof covering, half of which is recylced, and this month (January) the installation of the timber cladding is due to begin.

"The Aquatics Centre is on track for completion in mid-2011 and the sweeping roof, which will form the 'Gateway to the Games', is now a fixture in the skyline alongside the Olympic Stadium," said Olympic Delivery Authority (ODA) Chief Executive David Higgins.

Commenting further on the recent construction progress, ODA Chairman John Armitt, said: "The external structure of the Olympic Stadium has been finished, work is also racing ahead in the north of the park with the first residential plot of the Village structurally complete, the huge steel frame of the International Broadcast Centre in place and the striking architecture of the Velodrome taking shape."

Left: The Olympic Village will deliver a lasting legacy of new housing including 2,800 homes and more than 1,000 affordable apartments

Right: The steel framed Energy Centre will have a number of sustainable features setting a benchmark for future schemes

Left: The Olympic Stadium's external structure is complete with work underway to install its cable net roof

Right: The steel frames for the International Broadcast Centre and the Main Press Centre are largely complete

AROUND THE PRESS

Building Magazine
30 October 2009
The battle of the oil can
(Museum of Transport, Glasgow) The roof structure has big connections at the nodes of each peak and trough. These are needed to hold it in its folded form - if they weren't strong enough the roof would unfold itself. Two metre long steel cylinders were used as this made it easier to join all the connecting steelwork to the nodes - in some places, up to 12 steel members join the nodes.

Building Magazine
20 November 2009
All's well that ends well
(RSC Stratford) The tower has a steel and glass viewing box at the top. To save time, and to make the job safer, the box was prefabricated on the ground while the tower was being built and craned into position at the end.

The Structural Engineer
3 November 2009
Castle House wind turbines
Due to the complex geometry of the build, all of the secondary steel brackets had to be unique. Each one is a different size, pitch, and angle and had to be welded to the structure in various planes to fix the cladding to the elliptical structure.

Construction News
19 November 2009
The new school tie
Concrete would have been too heavy as the building hadn't been designed to take that kind of load, so we had to opt for steel.

Contract Journal
11 November 2009
Steel city learning curve
Standing on a hillside overlooking Sheffield, the dynamic new eight-storey building will feature a curved glass facade protecting a six-storey steel frame cathedral-style atrium and, just to ensure it stands out, will also include three 15m wind turbines on its roof.

Construction News
26 November 2009
Project with nerves of steel
Balfour Beatty Project Manager Roddy Mackay says: "Recently, most of the structural designers have had a tendency to design in steel. Concrete has been viewed as less flexible and a slower construction solution."

Construction Act amendments become law

On 12 November last year amendments to the 'Construction Act' became law as Part 8 of the Local Democracy, Economic Development and Construction Act.

Once these changes come into force, the amended Act will apply to all construction contracts, not only those wholly in writing. There are major changes to the payment system making it easier for a debt to be defined, with consequential changes to what are currently called withholding notices.

Pay when certified clauses will be banned, meaning that it will no longer be possible to tie release of subcontractor retention to issue of a certificate under the main contract, and parties will be able to choose whether to suspend some or all obligations for late payment and will be entitled to their reasonable costs, as well as time (as at present).

There are also changes to costs in adjudication to get rid of the abuse whereby contracts specify that the party starting the adjudication must pay all costs irrespective of the outcome of the adjudication. Contracts will now be obliged to give adjudicators the right to correct minor 'slips'.

The Scottish Parliament and Welsh Assembly are given powers to exclude certain contracts from the Act, whereas this power was previously reserved to the Secretary of State.

To allow contract writing bodies time to update their contracts as well as allowing time for the Scheme for Construction Contracts to be reviewed, it is likely that the new law will not be brought into effect until 2011.

Europe's tallest building rising fast

The Shard development, Europe's tallest and first major mixed-use building has reached the point where its steel skeleton is appearing over the top of London Bridge Station and is becoming a visible presence to the users of the rail terminus.

The steel frame that will form the backbone to the 310m high Shard reached floor five of its 72 storeys during December.

Overall the development will offer approximately 130,064m^2 of floor space and comprises of two buildings, the Shard and the smaller London Bridge Place.

The Shard will offer 54,441m^2 of prime offices, a five-star hotel, restaurants, residential apartments and viewing galleries. London Bridge Place will have 38,926m^2 of commercial office space and will be linked to its larger neighbour via a piazza.

Severfield-Reeve is erecting the steelwork for the project.

Port Eglinton Viaduct on the move

The largest of four steel structures on Glasgow's M74 Completion project has begun to be erected by steelwork contractor Cleveland Bridge. Known as the Port Eglinton Viaduct, the structure consists of 12 spans, five of which were erected during September and November.

Approximately 14,500t of steel will used on the viaduct which will carry the new M74 motorway extension across the West Coast Mainline, the SPT Underground tunnels near West Street Station, the Paisley, and City & Union rail lines, and Eglinton Street, one of the busiest roads into Glasgow city centre.

Box girders for the viaduct are being assembled close to the erection points at designated assembly yards. For the spans already erected, 30 girders were pre-assembled into 50m to 70m long sections, each weighing up to 200t, and each requiring one individual lift to position it during night time rail and road possessions.

Early this year the longest span of the viaduct, a 200m-long pre-assembled section, complete with concrete deck, will be launched over the West Coast Mainline during successive night time rail possessions.

BCSA Membership pre qualifies for Health & Safety

The proliferation of health and safety pre-qualification questionnaires has placed increasing burdens on small and medium sized businesses (SMEs) to repeatedly pre-qualify for both public and private sector work.

"This situation has become an unacceptable business burden to many small contractors and in turn, leads to a negative view of health and safety," said Pete Walker BCSA Safety Manager.

In order to help its members, the BCSA has joined the Safety Schemes in Procurement (SSIP) Forum which has recognised that the BCSA membership assessment process satisfies the Core Criteria for Health & Safety and therefore the members demonstrate they have qualified for health & safety and should benefit from the 'mutual recognition' arrangements.

SSIP acts as an umbrella organization for clients, contractors and consultants to facilitate further structured mutual recognition between schemes and others who carry out health and safety pre-qualification.

Using an SSIP Forum pre-qualification scheme for a Stage 1 assessment enables clients to concentrate on Stage 2 of the procurement process. The SSIP Forum members are also committed to advise and influence clients, contractors and consultants about reasonable interpretation and appropriateness of health and safety competence standards in UK schemes.

An important feature of the SSIP Forum is the HSE's message that a buyer can be confident a supplier who is registered or accredited as compliant or approved with an SSIP member has been assessed to the Core Criteria standard (stage 1).

The buyer, having verified their status, will only then need to focus on the project or job specific assessment (stage 2).

For further information, please contact BCSA Peter Walker on Tel: 01325 366328 or email *pete.walker@steelconstruction.org*

Success for steel projects at Structural Awards

The Infinity Footbridge which spans the River Tees at Stockton scooped the Supreme Award for Structural Engineering Excellence, as well as winning the Award for Pedestrian Bridges at the 42nd Structural Awards 2009 held at London's Natural History Museum.

More than 300t of structural steel was used on the Infinity bridge which is formed by two symmetrical arches spanning 180m. At its highest point the bridge stands 40m above the river.

The judges said the Infinity bridge was a bold and daring design which demonstrates what can be done with artistic flair, technical excellence, complex analysis and excellent engineering teamwork.

Main contractor for the project was Balfour Beatty Civil Engineering, while steelwork contractor was Cleveland Bridge.

One other notable category was won by a steel project as Cabot Circus Roof Structures was the winner of the Commercial or Retail Structures Award. Steelwork contractor on this job was SH Structures.

Metrolink depot takes shape with steel

Construction work on a new second depot for Manchester's Metrolink is continuing apace, with some of the tracks and the main frame of the workshop already in place.

The main depot building required 140t of structural steelwork - erected by Atlas Ward Structures - and measures 85m long x 35m wide and 10m high.

The depot, built on land between the Trafford Bar and Old Trafford stops on the Altrincham Metrolink line, will be able to house trams from early this year. It will only be fully operational by 2011, when it will also be used to carry out light maintenance.

Simon Russell, Project Leader, MPact-Thales, said: "After months of intensive work preparing the foundations, drainage and other key services on or below the ground, it's good to see the depot buildings begin to take shape above the ground."

The MPact-Thales consortium is made up of Laing O'Rourke, VolkerRail and Thales UK, and has been appointed to design, build and maintain the new Metrolink extensions.

NEWS IN BRIEF

Leighs Paints has announced changes to the loadings of all of its cellulosic range of intumescent coatings which now incorporate multi temperature assessments to the recently established criteria for acceptability. Introduced by the Intumescent Coatings Forum, the new criteria for acceptability aims to harmonise the way in which the industry carries out assessments, ensuring all intumescent coatings are assessed to the same criteria. The new data will enable a precise determination of the coating thickness for both structural fire engineered and cellular beam designs which must now incorporate multi temperature data for the beam's specified limiting temperature. For further information visit: *www.leighspaints.com*

Lindapter has expanded its decking fixing range with the launch of the Type MF, which allows building services to be suspended from Metfloor 60 and 80. The company said that the Type MF preserves the strength of the decking profile with no possibility of delamination (separating the steel from the concrete). The Type MF is available in sizes M6, M8 and M10. For further information visit: *www.lindapter.com*

According to a published report from Faithful & Gould, **Metsec's SFS** reduces construction costs by up to 39%. The report was based on a four-storey residential building and compared the SFS against blockwork both in conjunction with facing brickwork on the ground floor and lightweight render or timber cladding on the upper floors. The full report can be downloaded from: *www.metsec.com*

Voortman will be holding product introduction days at its factory in the Netherlands on 4th and 5th of February. The latest innovations in steel processing are promised including a fully automatic surface treatment system, a robotic plasma coping system as well as punching and shearing systems for angles. There will also be a series of seminars about steel machinery and fabrication. For more information email: *j.scheppink@voortman.net*

Gemini announces a new era

Machinery manufacturer FICEP said its recently launched Gemini 254 PG is the world's most advanced multi-function system for profile cutting, drilling, machining and scribing with integral bevelling.

The automatic CNC machine is also said to require up to 30% less floorspace than other systems and can produce flat metal parts from plate, 1mm up 80mm thick with cutting lengths from 5m to 30m.

The Gemini can be fitted with a variety of part-marking devices including plasma or flame powder marking systems. It is also equipped with the WinNest software package to maximise material utilisation. The Fanuc hardware is provided with a man/machine interface using the FICEP Minosse software.

Resourceful campus for Rugby

Warwickshire College's new campus in Rugby is nearing completion with the steel frame now fully erected.

Comprising a number of single, two and three storey structures, which are attached to form an inner courtyard, the project required steelwork contractor D.A Green & Sons to fabricate and erect 715t of structural steelwork.

One of the feature elements of the project is the roof of the college's fine arts block which turns up at two corners. Known as the 'quiff', this complicated steel roof structure was entirely formed with CHS sections and hot rolled purlins.

The college also features a curved sports hall which was constructed with a series of curved Westok beams. The hall will be suitable for basketball, five-a-side football, badminton and indoor hockey, and also includes changing facilities and a multi-gym.

Main contractor for the project is St Modwen Developments and the college is due to open in the Summer.

Steel posts green building for Royal Mail

A new 19,774m^2 Royal Mail hub and distribution centre, built by ProLogis in conjunction with Aviva Investors and featuring a number of green credentials, has been completed by main contractor Winvic.

Steelwork contractor Caunton Engineering erected more than 600t of structural steelwork for the project which is located in Swan Valley, a 210 acre distribution park next to junction 15A of the M1.

The building's green credentials have been boosted as ProLogis has reduced and offset all the embodied carbon associated with the construction. As a result, the predicted reductions in operational CO_2 will provide an immediate and significant environmental benefit, reducing building related CO_2 emissions by 77% by 2020 and saving 36,924t of CO_2 over the project's lifespan.

Structurally the building is 110m long x 145m wide, with three main internal spans of 40m and two of 35m. The project also incorporates a low level lean-to which houses office space.

Diary

For all SCI events contact Jane Burrell tel: 01344 636500 email: education@steel-sci.com

21 January 2010
Portal Frame Design
Bristol

26 January 2010
Light Gauge Steel Design
Slough

26 January 2010
Connection Design
Joint with ISE/London

28 January 2010
Steel Building Design to EC3 London

2 February 2010
Steel Connection Design
Birmingham

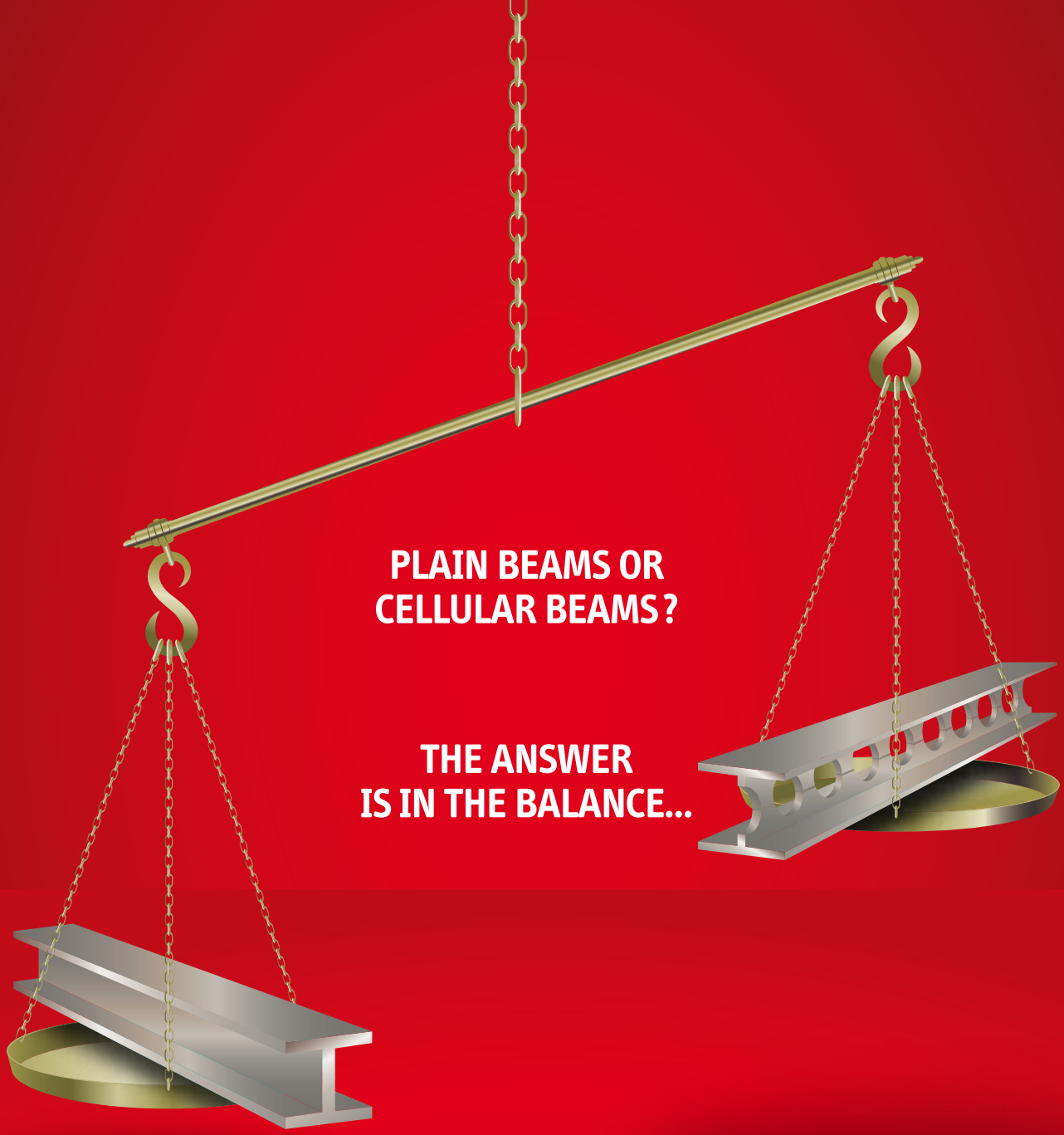
4 February 2010
Steel Building Design to EC3, Manchester

9 February 2010
Steel Frames & Disproportionate Collapse Rules
Sheffield

10 February 2010
Preparation for Eurocodes
Joint with ISE/London

23 & 24 February 2010
Essential Steelwork Design (2 day)
Bristol

25 February 2010
Floor Vibrations
Manchester



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A homecoming for the Seagulls

A spectacular steel arched roof, mirroring the surrounding countryside, will top Brighton & Hove Albion's new football stadium. Martin Cooper reports from a construction project 13 years in the making.

When Brighton & Hove Albion (the Seagulls) kick off the 2011/12 football season in their new 22,500 seater stadium it will bring to an end one of the longest running sagas in English football.

Since vacating the Goldstone Ground in 1997 the club has battled hard to have a new home of its own, with planning permission for its preferred site in Falmer going through two public enquires before being finally approved in 2008.

It has not been easy supporting Brighton, as following on from the acrimonious sale of the Goldstone Ground, the club suffered the ignominy of very nearly being relegated from the Football League to the Conference and then having to ground-share for two seasons with Gillingham, which involved a round trip of some 150 miles for players and fans alike.

The club finally returned to Brighton and settled at the Withdean athletics stadium, not a ground entirely suited to league football, but nonetheless the club's home until the new stadium opens.

Martin Perry, Chief Executive at Brighton & Hove Albion describes the construction of the new stadium as a dream finally being turned into reality. "We've fought long and hard for this project and now we can see the stadium rising up on the site.

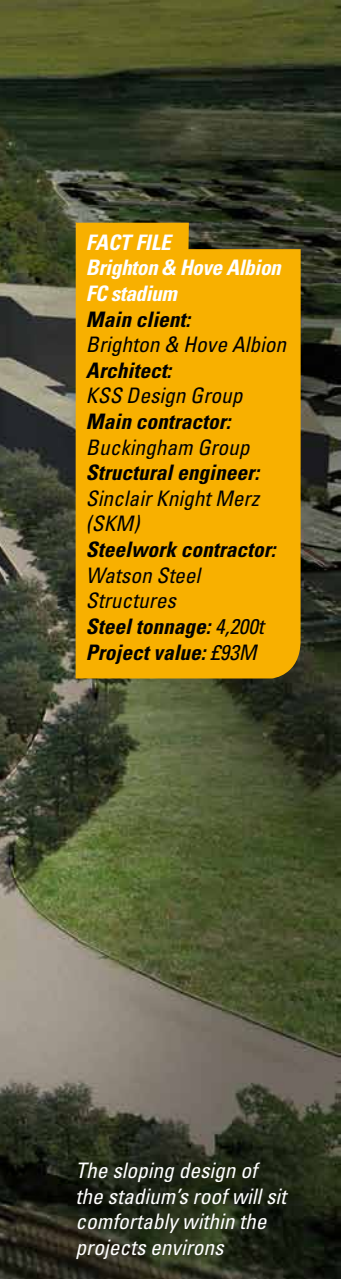
"There have been a few false starts along the way but now we can definitely plan ahead for life in our new stadium."

Before the Seagulls do kick-off in their new home a lot of construction work has to be completed. Situated alongside the A27 – nine miles from Brighton city centre – and conveniently next to an existing railway station, the site not only had a serious slope but also a large chalk hill running across it.

The roof is an undulating and sloping structure said to reflect the local landfall of the South Downs.

One of the initial tasks main contractor Buckingham had to perform when it started on site last April was to begin a large earthmoving operation, to level some of the site and enable access roads to be constructed.

A large earthmoving operation is under way to clear the area for the main West Stand



FACT FILE
Brighton & Hove Albion FC stadium
Main client: *Brighton & Hove Albion*
Architect: *KSS Design Group*
Main contractor: *Buckingham Group*
Structural engineer: *Sinclair Knight Merz (SKM)*
Steelwork contractor: *Watson Steel Structures*
Steel tonnage: *4,200t*
Project value: *£93M*

The sloping design of the stadium's roof will sit comfortably within the projects environs

Earth moving is on-going and involves the removal of some 140,000m^3 of chalk. "We have a large cut and fill operation whereby all overburden is removed to an adjacent council owned site," says Duncan Halliday, Buckingham Project Manager. "This obviously keeps trucks off of the local roads."

There is also some demolition work to undertake, as six recently vacated buildings, belonging to the University of Sussex and located on top of the chalk ridge which will be excavated, are to be removed.

As the site gets levelled, the structural works have been able to commence with the construction of the East and North Stands. The East Stand will be the stadium's second largest with two internal floors and one tier of terraced seating. The North Stand – which will house away supporters – is positioned behind one of the goalmouths and incorporates a single tier of seating.

Steelwork contractor Watson Steel Structures began its 12 month programme last July and will eventually erect approximately 4,200t of structural steelwork for the project. The four stands consist of traditional steel rakers supporting precast concrete terrace units, behind which the main structure housing concourses, toilets and shops is erected with steel beams and columns.

Steelwork also provides the signature element of the project, the roof. It is an undulating and sloping structure that is said to reflect the local land fall of the South Downs. Two large trusses will span either side of the stadium, above the West and East Stands, supporting this roof. The smaller North and South Stands will have more conventional cantilever roofs, but all four sides will be interconnected and this will mean temporary works will have to remain in place until the entire roof structure is completed in July 2010.

"The trusses support the roofs over the two main stands," explains Watson Steel Structures Contracts Manager Peter Riley. "But tying the whole roof structure together is a ring of steel which passes around the back of the entire stadium. Until the whole roof steelwork is up, we have to install and then keep in place temporary support towers."

The truss over the East Stand will be erected during the weeks leading up to Christmas. It measures 170m-long and will be delivered to site 'piece small' and then assembled into three liftable sections on the pitch.

The East Stand's roof truss will be assembled in three sections and lifted onto temporary trestles which will remain in place until the opposite West Stand is completed

Assembled on temporary trestles, the three truss sections will be lifted into place individually by crawler crane. Holding the truss in position at either end are two enormous heavily reinforced 'thrust walls' which have been partially buried into the ground. Cast-in plates connected to steel bearings, weighing seven tonnes each and designed to resist a thrust of 20,000kN (2,000t) – connect to either end of the steel truss.

The long and winding road

The Goldstone Ground was the home of Brighton & Hove Albion from 1902 until April 1997, when the club played its last game at the stadium against Doncaster Rovers. The sale of the ground, implemented by majority shareholder Bill Archer and his Chief Executive David Bellotti, proved controversial as the club received little money from the transaction.

Paying for an ensuing public enquiry, rent for the current Withdean Stadium, fees paid to Gillingham for ground-sharing, and a general running deficit meant by 2004 the club was £9.5M in debt. This huge debt was paid off partly through a large scale fundraising appeal involving the club's fans.

In October 2005 the news which everyone had been waiting for arrived when the Office of the Deputy Prime Minister announced that the application for Falmer had been successful. Hopes were quickly dashed when Lewes District Council contested this decision forcing a judicial review. This was based on a minor oversight which neglected to state that some car parking for the stadium is in Lewes as opposed to Brighton. This obviously caused further delay, but once the judicial review ruled in favour of the stadium, Lewes said it would not launch further appeals. This was indeed good news for the football club and construction work was able to begin.

The North Stand, which will accommodate away supporters, takes shape

The sequence for the truss erection will commence with the 60m long x 19m high x 12m wide southern section. Once in position this 120t section will be supported by one of two temporary trestles. The 55m-long x 13m high x 12m wide middle section is then lifted into place and bolted to the first section and again supported on a temporary trestle. The final piece of the truss 'jigsaw' will see the northern section, which is a similar size to the southern section, lifted and bolted into place.

"Tying the entire roof section together is a ring of steel which passes around the back of the entire stadium"

As well as the truss temporary trestles, temporary restraints are also required at both bearing locations to

stop the truss literally lifting off before the entire structure is in place.

Once the truss is fully erected Watson will then install the roof steelwork which connects to the back of the stand, as well as cantilevering rafters which form the front of the roof structure. Once the underslung lighting gantries are in place the entire East Stand roof steelwork will total a 675t.

Earthmoving and chalk removal continues on site and once complete next year a similar procedure will be conducted to install the roof over the largest stand - the three tiered West Stand.

"The West arch roof truss will be similar in many respects," says Mr Riley. "But different in that it supports a larger area and will therefore be heavier."

More than 200t of cold formed bespoke purlins and rails will be supplied for the roof structure by Albion Sections.

The entire steelwork package is scheduled for completion in July 2010, with overall construction completion due in May 2011. This is three months before the 2011/12 football season kicks off, with the only remaining question being – which division will Brighton & Hove Albion be in then?

The lower part of the East Stand complete and ready for the roof truss erection to begin

Steel making provides energy solution

As part of Corus Port Talbot's quest to find alternative forms of energy, a large steel framed gas holder has been commissioned. Martin Cooper visited a project with environmental, cost and energy efficiency credentials.

A major energy efficiency scheme has been commissioned at the Corus Port Talbot steelworks in South Wales, with structural steelwork playing an integral role. The new BOS Gas Recovery Project will allow the facility to harness the off-gas, rich in carbon monoxide, generated by the steel making (BOS) process as a source of energy for on-site power plants.

To facilitate this new process, a large gas holder along with 3km of associated pipework and two 70m high stacks, have been built with steel, which was fabricated, supplied and erected by Rowecord Engineering.

Explaining what all of this new installation is producing, Corus Project Manager Guy Simms, says: "This isn't new technology nor is the concept as there are many plants around the world and within the Tata Steel Group already recovering BOS gas.

"But the financial and environmental benefits of the full scheme are very attractive especially given the rise in energy costs over recent years."

This is easy to understand, as it is obviously better to harness the energy in the gas by making electricity rather than to burn it. Previously, all BOS off-gas produced at Port Talbot was flared off. Now it replaces Coke Oven Gas (COG) to supply power plants, with the knock-on effect being a 60% reduction in on-site natural gas imports. Natural gas is currently used to fuel the reheat furnaces in the hot mill, COG now not needed for power plants is diverted here instead.

The expectation that energy prices will remain high, combined with the pressures linked to climate change and CO_2 generation, have driven the project along with the site's long term vision for energy self-efficiency.

Remarkably the payback period for this multi-million pound project is only two years. "Every year after that there will be an ongoing financial benefit, derived from less natural gas imports and a 15% reduction in electricity imports as well as the social and environmental benefit of reducing our CO_2 emissions by 250,000t per annum," explains Mr Simms.

Central to the scheme is the new 75,000m^3 gas holder which has been constructed roughly equidistant between the power plants and the BOS plant. Approximately 2,700t of steelwork went into this large structure which is 63m-high to the apex of its roof top vent, 54m in diameter and erected from steel plates.

Constructing a large gas holder is not an everyday occurrence and John Blackwell, Managing Director for Rowecord says they followed the advice of project designers Lazarus, a company that has built similar type structures all over the world.

"To avoid excessive working at height and to minimise the use of scoffolding, the entire gas holder was built from the roof down," explains Mr Blackwell. "We completed one ring of steel at a time by using hydraulic jacks to lift the whole structure up to allow the next ring to be installed."

Early works on site involved ground preparation and piling, prior to a concrete slab and a steel floor plate being installed. This then allowed the main steel erection programme to begin, with the uppermost ring of plate steel installed first. Each steel plate is 2.4m high x 11.3m long and one circumference – with welded connections – took seven days to complete.

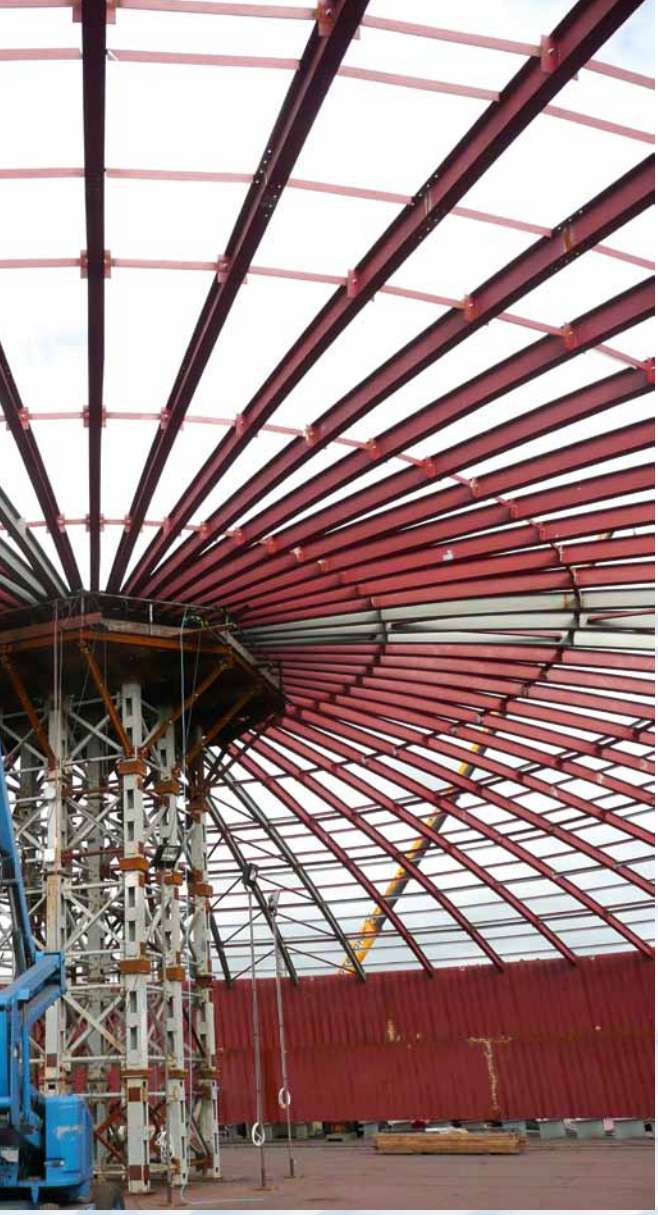
Next the roof framework was erected consisting of a series of 600mm deep rafters which fan-

Above left: The gas holder's upper sections were erected first

Above: The roof's steel-work is bolted into place

"The entire gas holder was built from the roof down."

FACT FILE
BOS Gas Recovery Project, Corus Port Talbot
Main client: *Corus*
Main contractor and steelwork contractor: *Rowecord Engineering*
Project designers: *Lazarus Associates*
Process designers: *Siemens*
Steel tonnage: *8,200t*
Project value: *£60M*



Above: The 63m high gas holder nears completion

out to the perimeter from a central point that was temporarily supported on a trestle. The roof structure also includes steel bracing while all connections for this part of the structure were bolted.

Once the roof was clad the structure was raised by a series of hydraulic jacks placed around the circumferences. The jacking process took approximately five hours and raised the entire steel ring 2.4m, which allowed another complete circumference of steel plates to be installed, before the process was carried out again and again until the gas holder reached its full height.

As each successive circumference of steel plates was inserted the structure's weight increased and so the number of jacks had to be increased from 24 at the start of the procedure to 120 units at end. Likewise, the steel plates' thickness also increased – due to extra loadings – from 10mm for the upper rings to 16mm thick plates at the bottom.

The final steel ring included a 6m wide access opening, which served the dual purpose of allowing the cherrypickers, used inside the structure's footprint, an exit route and allowed the gas holder's internal steelwork to be inserted.

Internal steelwork was brought to site 'piece small' and once inserted via the access door it was bolted together. This steelwork most importantly included the 18m-high piston which when assembled weighed 480t.

As gas enters the holder the piston, which rests on a lattice framework at ground level, rises to 1.5m from the roof when full. As the piston rises an attached rubber membrane, fixed to both the piston and the wall of the holder, unfolds and acts as a seal preventing gas leaks.

"Almost every works area in Port Talbot will be affected by the project in one way or another and most have required some engineering work. Even outside the site there were a number of challenges, due to the size and geometry of the components, which were delivered. All in all, the logistical challenges have been very demanding," sums up Mr Simms.

What else does the project involve?

Aside from the gas holder, Rowecord also fabricated and installed 3km of pipework, from the BOS plant to the holder and then on to the power plants. Pipework taking gas to the holder is 2.6m diameter, with the longest section brought to site being 40m-long. Exiting the holder the pipework is 1.2m diameter due to the gas being less dense as it has undergone a dust extraction process within the holder.

"The pipework network was challenging as the route is never straight," explains Mr Blackwell. "The pipeline, which is raised above ground level, has numerous elbows and bends to navigate around various buildings and plants within the facility, this accounts for the length."

Three new flare stacks, to burn off excess gas, have also been erected. These chimney-like structures weigh 160t and were fabricated by Rowecord from steel plate and delivered to site in three sections and welded up on site.

World class pool dives in

The need for a fast construction programme and a structure with long open spans resulted in the choice of a steel frame for a new swimming pool and diving facility in Southend.

Above: Once the majority of the steel frame was up, excavation of the pools began

Below: The truss which supports the plant area was installed in two halves in a tandem lift

The eagerly anticipated build-up to 2012 Olympic Games is coming to Southend-on-Sea, as a new swimming pool and diving facility under construction in the Essex seaside town has been selected as a pre-Games training camp.

Supported by Sport England, the project includes an international standard diving pool, a 25m eight lane competition pool, seating for 398 spectators and is also expected to be a key training facility for Team GB's diving and Paralympics team ahead of the London Olympic Games.

"This is a highly prestigious scheme for the town," says Kate Trueman, Southend Borough Council's Leisure and Sports Manager. "It will be open more than a year before the Games, allowing plenty of time for various teams to train here, and putting Southend on the sports map."

Adjoining the town's Garon Park leisure and tennis centre, the new facility wraps around and links into the existing building. A new entrance for both facilities is being constructed and the entire project is due for completion by September 2010, the culmination of a 67 week construction programme.

The site is very tight, with existing buildings and an outdoor sports ground on one side, and a school running along another site boundary. Bearing this in mind, main contractor ISG Jackson had to sequence the early works, whereby the site was levelled and contiguous piles installed around the pool and diving area, prior to the steel frame being erected.

"Sequencing was very important," explains Phil Holland, ISG Jackson Site Manager. "The work area is quite small so we had to limit the number of trades on site at any one time."

Once the majority of the steelwork was erected, by contractor D.A Green & Sons, the pools were then excavated. This was the only viable option as some of the steel members are so big they needed to be lifted into position by a crane positioned within the structure's footprint.

"If we'd have dug the pools first there just wouldn't have been any room to put the cranes," explains Mr Holland.

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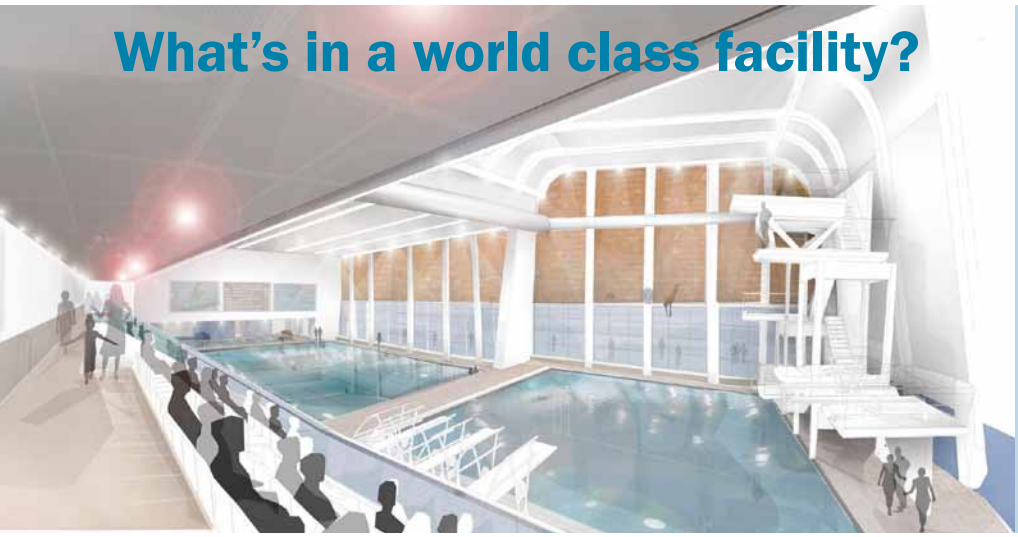

Southend's new swimming pool and diving facility will replace the town's aging Warriors Swim Centre and its main focus will be a 25m eight lane competition pool. Adjacent to this will be a 15m × 6m leisure and learner pool, and a diving pool with 3m, 5m, 7.5m and 10m platforms, each 3m wide for synchronised diving. The 6m deep diving pool will include a hydraulic movable floor to enable it to be used for swimming lessons and/or exercise classes.

Overlooking the pool and dive area is a tiered seating area consisting of 398 fixed seats as well as wheelchair spaces.

Other facilities will include a dry diving training area equipped with special harnesses and trampolines along with changing rooms, showers and a new entrance area with access into the adjacent leisure and tennis centre.

"We had to leave a couple of critical openings in the steel frame to allow plant equipment and materials access into the structure," adds Ian Burchnall, D. A Green Contracts Manager. "Once the facility's interior is completed we'll fill in these openings with secondary steelwork."

Because of the site's confined position the section of the steel frame adjoining the existing building was erected first. The steelwork was then erected in a southwards direction towards the site's access point.

"In this way we were able to bring our steel to site and erect it in such a way that we always had room for storage and never hemmed ourselves in," says Mr Burchnall.

This sequence meant the changing room area, which also contains a mezzanine floor with a dry diving practice area, was erected first, followed by the frame for the main pool and then finally the area over the diving pool.

The majority of the structure features long clear spans with the frame stabilised with braced bays along the main elevations. The width of the main structure is 25m, consequently the long span roof rafters were brought to site in two pieces (12.5m each) to avoid any delivery problems.

"If we had dug the pools first there just wouldn't have been any room to put the cranes."

All steel erection was conducted via mobile crane and the roof rafters were bolted together on site and then lifted into place as one 25m long 5t section.

To provide the required long spans three storey-high trusses have been installed within the structure. One truss, measuring 20m long x 7.5m high, spans the main structure's width and supports the mezzanine floor to provide a column free area between the pool area and the changing rooms.

The other two trusses were made up of two halves and were positioned side-by-side along the western elevation supporting a suspended plant area. Overall these trusses are 53m long and rise from 4m deep to 9m. They were brought to site 'piece small' before being assembled into four parts.

"Access to the site dictated the size of steel sections we could bring to site," explains Mr Burchnall. "Once we had assembled the two halves of each truss, each weighing approximately 5t, they were erected in a tandem lift with two mobile cranes, which held them in position while they were bolted together."

The steel frame building will also feature a range of architectural finishes to its facade, including large areas of curtain walling, render panels and metal cladding, with a metal clad roof. One main elevation, opposite the seating area, will be glazed and so 17m high 406 diameter CHS columns have been used along this perimeter, purely for aesthetic reasons.

The scheme will achieve a 'Very Good' BREEAM rating and incorporates a lagoon area to assist with water attenuation.

Summing up the project, MLM Director Rob Seller, says: "The complex was always going to be a steel structure because of its shape and long internal spans. However, early in the design process we did some value engineering and changed the design from a portalised frame to its present braced frame. This resulted in a huge cost saving for the client as the steel tonnage was reduced from 600t to 325t."

FACT FILE
Southend pool and diving facility
Main client: *Southend-on-Sea Borough Council*
Architect: *Archial*
Main contractor: *ISG Jackson*
Structural engineer: *MLM*
Steelwork contractor: *D.A Green & Sons*
Steel tonnage: *325t*

Below: A mezzanine level containing a dry diving area is supported by a 20m long truss

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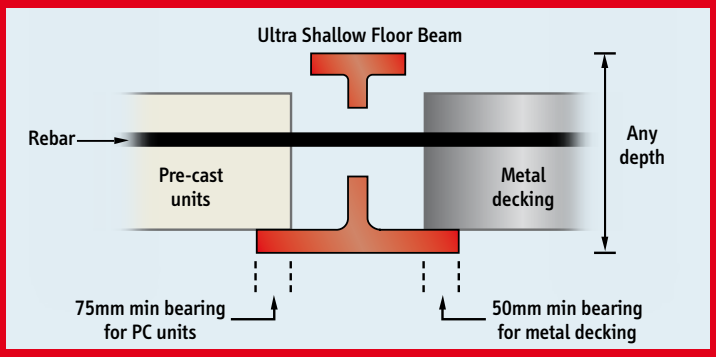

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Landmark development for Euston Road

On the site of a former hospital, a prestigious commercial and residential scheme is taking shape with the aid of steel's speed and lightweight construction.

Unison's new headquarters features three new office blocks including one prominent nine storey structure

FACT FILE
Unison headquarters, London
Main client: *Unison*
Architect: *Squire & Partners*
Main contractor: *BAM Construction*
Structural engineer: *AKS Ward*
Steelwork contractor: *Graham Wood Structural*
Steel tonnage: *600t*
Project value: *£47M*

Next year Unison, the second largest trade union in the UK with over 1.3M members, will be relocating to a new headquarters building on one of the most prominent sites on London's Euston Road.

Currently occupying a rather tired looking 1970s concrete edifice, only a stone's throw from its new building, Unison's aim is to create a state of the art, modern campus-style development on a site previously occupied by University College London Hospitals.

As well as office accommodation, the new site also includes residential buildings consisting of 47 apartments, as well as incorporating a Grade II listed Victorian building – originally built as a specialist hospital for women by the medical pioneer Elizabeth Garrett Anderson, which is being restored.

The site is located on the northside of Euston Road, halfway between Euston and Kings Cross railway stations. The scheme maximises the one acre site by linking the retained Victorian element to three new office buildings (known as A1, A2 and A3) via walkways and a central glazed atrium. Three residential blocks are situated towards the back (blocks C, D and E), while a fourth (block F) is located along the eastern boundary facing Chalton Street.

"As a lightweight frame was needed for the residential structures, a steel frame with timber floors was chosen."

Main contractor BAM started on site during the summer of 2008, completing a demolition phase of the buildings that were later additions to the original 1898 building that has been retained. The listed building has been stripped back to allow structural repairs to be carried out. The old roof has been stripped but the roof tiles salvaged to be relaid onto a new roof stucture. When the renovations are complete, the Victorian building will be incorporated into the new complex with meeting rooms and offices for Unison and a ground floor exhibition celebrating Elizabeth Garrett Anderson.

The majority of the new structures are steel framed, with the exception of residential blocks C and F, which are concrete. "The office blocks are steel framed for speed of construction," explains Paul Joyce, Senior Project Manager for BAM. "Two of the residential blocks – D and E – are also steel framed and this is because they sit above a concrete podium with a car park below and a lightweight solution was needed."

Steelwork erection began last August, and contractor Graham Wood Structural will eventually install close to 600t of structural steelwork for the project. The three office blocks were erected first as these were easiest to access from the site's only entry point which is located along the western boundary on Church Way.

The tallest structure on the site, the nine-storey office block A1, was the first steel part of the project to get underway, followed by the five-storey structures A2 and A3. All of these buildings have been erected around a similar grid pattern featuring 12m long Westok beams for all floors, with stability

predominantly derived from concrete cores.

Sequencing played a major role in the steel erection programme, as other trades, most notably the concreting for floor slabs, had to be taken into account. Steel for A1 was erected up to floor five, then the concrete contractor was allowed access to the structure to cast floor slabs, while Graham Wood commenced erecting A2 and then A3 to their topmost levels.

"In this we were able to keep ahead of the concrete team, as once we'd erected A3, we could then go back and erect the final four floors of A1," explains Pat Whelan, Site Manager for Graham Wood. "The sequencing also had a programming element as erecting the steel frame above five levels would have made it difficult for concrete team to get their equipment into the structure by crane."

The top floor of block A1 will be utilised as a conference chamber and features a 7.5m high floor height, double that of all the other levels. "Aside from this, the three office structures were fairly straightforward to erect although a lot of coordination was required to make sure the interaction with the precast cladding units was correct," says Mr Whelan.

Below: 12m long Westok beams provide the office blocks with the desired open column free areas

Block A1 is the project's centrepiece building overlooking Euston Road and is adjacent to the retained Victorian structure with block A2 directly behind. Separating A1 and A2 from the retained building and A3 (which is behind the retained Victorian structure) is a glazed atrium spanning the void and constructed with a steel frame.

"To distribute the loads being transferred to the Victorian brickwork a concrete spreader beam has been installed along the old building's eaves which will support part of the atrium's steelwork," says Paul Livesey, AKS Ward Operations Director.

Block A3 which abuts the flank wall of the retained building, has a rigid steel frame along the connecting elevation consisting of stiffer beams and columns with extra bracing at basement level. The new steelwork which connects into the brickwork of the Victorian building sits on PTFE pads to allow differential lateral movement.

The steelwork trusses sit on roller bearings connected to the spreader beam preventing lateral thrust being transferred into the old brickwork. Therefore the load bearing brickwork facades will only support vertical loads.

The two final pieces of the steelwork erection jigsaw will see Graham Wood erect residential blocks D and E. Both of these structures had to be sequenced last as they are located on the area previously used as the site's delivery and lay down area.

A concrete podium covering plant rooms and a small disabled car parking area will occupy much of this area's available space, with both of the residential buildings sitting on top.

"As a lightweight frame was needed for both of these structures, a steel frame with timber floors was chosen," adds Mr Livesey. "The car park has a much larger grid pattern which doesn't match up with the residential structure's grid, so steel again met the requirements."

The project is due for completion in October 2010.

Above: Block A3, which abuts the project's retained Victorian building, takes shape

Steel sector ready for Eurocodes

The biggest change to codified building design ever in the UK will take effect in March, and the steel construction sector is fully prepared. Nick Barrett reports on the launch of the first tranche of design guides that will support the change.

One of the keys to success in using the new Eurocodes will be getting properly to grips with the content of the accompanying National Annexes, speakers stressed at the Eurocodes steel design guides launch in London. But all the advice and guidance that designers need will be to hand from the steel construction sector.

The BCSA, Corus and SCI have produced a series of helpful design guides:

Steel Building Design: Introduction to the Eurocodes.
This is a high level document that introduces the Eurocode system and sets out the format used. It also explains the relationships between the Eurocodes, the National Annexes and Non-conflicting complementary Information (NCCI).

Steel Building Design: Concise Eurocodes.
This publication provides a concise compilation of the design recommendations for common building design in the UK based on the Eurocodes and the UK National Annexes.

Steel Building Design: Design Data (Blue book).
This publication presents design data in tabular format to assist engineers who are designing buildings in accordance with BS EN 1993-1-1: 2005, BS EN 1993-1-5: 2006 and BS EN 1993-1-8: 2005 and their respective National Annexes.

Steel Building Design: Worked Examples – Open Sections.
Includes worked examples for open sections and connections to the Eurocodes. These include restrained and un-restrained beams, columns in simple construction and simple connections (flexible end-plate).

Steel Building Design: Worked Examples – Hollow Sections.
Worked examples for hollow sections members including ties, beams, and columns in simple construction.

Steel Building Design: Worked examples for students.
This publication presents a brief introduction to the Eurocode system and worked examples based on a multi-storey building. Members (beams and columns) are taken for a multi-storey building and designed to the Eurocodes.

Steel Building Design: Medium Rise Braced Frames.
This is a Eurocode update of the existing publication on the design of medium rise buildings.

Eurocode Load Combinations for Steel Structures.
This publication presents practical guidance on combinations of actions (load combinations) for two principal types of steel structure – multi-storey buildings and industrial buildings.

Guides to be published next year include:

Handbook of Structural Steelwork (Eurocode version) (Red book).

Joints in Steel Construction – Simple Connections (Eurocode version).

Combined Torsion and Bending.

Also next year guides will be published for composite highway bridges, fire engineering, and composite members.

Event chairman Chris Dolling of Corus hailed the introduction of the Eurocodes as the most significant development ever in UK design codes. Mr Dolling said that extensive experience of the steel construction sector with the development of the Eurocodes meant that there was a wealth of knowledge for designers to call on to support the move to Eurocodes. "Eurocodes will quickly become the accepted standard in the UK," he predicted. "They are all that future graduates will know of and design offices would find it inefficient to run both Eurocodes and BS5950 side by side."

David Brown, Associate Director of SCI, said there were significant challenges associated with Eurocodes coming into effect in March 2010, but he stressed that they were manageable. "Nothing fundamental is changing, it is still the same physics after all, albeit presented in a different way. The importance of the National Annexes has to be emphasised as it is easy to miss something important if you fail to study them properly", he said. Every design office should have at least one person whose job it is to get a tight grip on the National Annexes, as serious errors could be made.

There is a multitude of documents to be grappled with as well as the key National Annexes, but there is nothing that cannot be managed quite easily, and all the problems that are likely to arise with their introduction are solvable. Issues are a lack of familiarity that will vanish with modest experience.

Among the key presentational changes are that resistance checks are presented by structural phenomena, not design route. There are fewer look up tables and hardly a graph to be seen. There will be an increase in the use of equations, with more use of Greek symbols, and a lot of subscripts.

Advantages from using the Eurocodes will soon become apparent, predicted Mr Brown, who reinforced this in some technical demonstrations along with SCI's Edurne Nunez Moreno. An 8% reduction in floor loadings would be one economical outcome from using the Eurocodes.

Mr Brown concluded that if he were to return to working as a steelwork contractor, he would without hesitation choose to use the Eurocodes for design immediately. "Designers will quickly see the advantages."

BCSA's Dr David Moore explained that the steel sector's approach to supporting the introduction of Eurocodes has been different from the route chosen by some other sectors. The steel approach has been to develop pan European resources to as great an extent as possible, and to deliver them free

as web based assets and to continuously improve and expand these assets.

A wealth of resources is available to designers and the core asset is Access-steel (*www.access-steel.com*). This has been funded by seven European steel producers with support from the European Union, developed by a consortium of technical institutes in the UK, France, Germany, Spain and Sweden. It contains 250 items of core information, including 11 interactive worked examples relevant to multi-storey building design

Courses are being provided by the SCI and others as required. SCI for example runs a two day course on Essential Steel Design to both BS5950 and EC3 as well as one day courses on steel buildings and steel bridge design to EC3. Courses can be organised in-house; and companies and other organisations can cost effectively combine to hold in-house courses. (*www.steel-sci.org/Courses*).

A useful route into advice is simply to google Steel NCCI where the relevant NCCI's (Non Contradictory Complementary Information) is listed and can be searched by text or clause, queries can be forwarded to the relevant UK steel sector experts and useful links are provided. The NCCI's contain guidance supporting the use of Eurocodes that is not provided in the Eurocodes themselves.

Dr Moore outlined the responses of commercial steel software developers to the introduction of Eurocodes, with all of them either having made, or are making, substantial progress in ensuring that familiar software can continue to be easily used. Other publications and website based material will continue to be produced including a publication to be called Eurocode Load Combinations for Steel Structures, which can be obtained via the BCSA's website *www.steelconstruction.org*

Also for the future, Dr Moore said there are moves afoot to have sustainability addressed in Eurocodes. Designers are reminded that the Building Regulations in England and Wales allow any safe method of design to be used, including withdrawn British Standards. The Department for Communities and Local Government has decided to postpone amendments to Approved Document A - Structure until 2013. Consequently, AD-A will continue to reference British Standards such as BS 5950 as acceptable methods of complying with the Building Regulations.

Useful websites

Access Steel	www.access-steel.com
Steel NCCI	www.steel-ncci.co.uk
Corus Construction	www.corusconstruction.com
BCSA	www.steelconstruction.org
Steelbiz	www.steelbiz.org
Steel Essentials	www.steelessentials.info
New Steel Construction	www.new-steel-construction.com

FACT FILE
Belfast Metropolitan College, Titanic Quarter Campus
Main client: *Belfast Metropolitan College*
Architect: *Todd Architects*
Main contractor: *Patton Construction*
Structural engineer: *Mott MacDonald*
Steelwork contractor: *Walter Watson*
Steel tonnage: *1,500t*

College kickstarts Titanic scheme

Belfast's once thriving shipyards, now rechristened the Titanic Quarter, are in the midst of a major redevelopment with a new college one of the first projects to get underway.

Where once the famous RMS Titanic passenger liner was built and launched, a new dynamic district, including apartments, educational establishments, offices and riverside entertainment is now planned in Belfast.

Aptly named the Titanic Quarter, this 185 acre site, formerly known as Queen's Island and previously owned by the Harland and Wolff shipyard, is situated on reclaimed land in the city's harbour and set for a transformation.

Due to open in 2011, one of the first projects to get underway is a new premises for Belfast Metropolitan College, which will replace two existing and outdated college buildings in the city centre. The new college will have a capacity for 2,500 students and offer a wide of range courses including hospitality and catering, business and management, performing arts, craft and design, science, and sport and leisure.

Todd Architects' Emma Logan, says the concept for the development is founded on creating a strong campus identity which will convey its civic role, respond to best practice educational principles and become a vibrant living community for those who work there, study or visit.

The steel framed building comprises a pair of cranked 'arms' embracing an inner courtyard. Vertical circulation, services and sanitary facilities have been clustered around the joints between the blocks. The arms have four storeys of teaching accommodation, linked at the southern end of the site by a series of inhabited bridges contained within a five storey triangular atrium.

The main focus of the southern end, or front, of the college is not only the building-high glazed atrium but also its ship-like triangular tip, which has been dubbed the prow. The northern end of the structure meanwhile, where the two wings converge is linked by three footbridges spanning the access route into the site's basement car park.

"With just one erection team we erected 100t a week."

Commenting on the college's apparent ship-like appearance, Ms Logan says the main driver for the project's design was in fact the available plot of land and not the surrounding shipyards and nautical heritage. The perceived ship-like appearance is coincidental. "The shape of the plot dictated the design of the structure as it follows the line of the surrounding streets and the front wedge is orientated towards a complex geometry of roads."

Steelwork contractor Walter Watson erected 1,500t of structural steelwork for the project during a 15 week programme. "Speed of construction is important for this job," explains Trevor Irvine, Walter Watson General Manager Structural Division.

"With just one erection team we erected 100t a week."

Beginning with the five storey prow and atrium, Walter Watson erected steelwork in a northerly direction completing the two wings last. The structure sits atop a large concrete podium containing an underground car park, which was completed prior to steelwork erection beginning.

Aside from the atrium which features 15m clear spans, the majority of the project is based around a repetitive 7.5m x 7.5m grid pattern. The erection was phased with the initial sequence seeing the five storey element being erected up to third floor level and the wings up to second floor level. This allowed the concrete contractor to follow on behind and cast floor slabs, before the upper levels of steelwork were added.

Interestingly, the college was not always envisaged as a steel framed structure as Mott MacDonald's Project Engineer Steve Evans points out. "During the bid stage a concrete frame was favoured, but as the local construction market was busy at the time there were supply concerns and in the end a steel frame was chosen. However, due to the repetitive nature of the building grid, the steel frame option actually offered a number of significant benefits, not least the speed of construction."

Another consideration was that the columns in the basement do not bear any comparison to the desired grid pattern for the college structure above. With the 475mm thick concrete slab acting as a transfer structure, the lightweight frame proved to be a highly efficient solution that facilitated ongoing design development that continued throughout the early phases of construction.

The steel frame has a mixture of concrete cores and vertical bracing supplying the needed stability. Because of the large amount of windows along all elevations, bracing has been secreted in blockwork cavities or partitions.

The main entrance to the new college will be to the side of the tip of the prow and this will lead visitors and students alike into the atrium. The characteristic tip of the prow has been formed with a series of CHS columns along two converging elevations, with beams spanning between them.

To the back of the atrium there are five levels of student support facilities and classrooms separated from the structure's two wings by a movement joint, which is positioned where the building steps down from five to four levels.

The wings have been formed with a beam and column construction except for the top level of each wing, where a series of portal frames have been installed.

"The top floor of each wing was portalised to provide column free teaching spaces," explains Mr Evans. "In the event, this simple approach in steel provided an elegant solution that was easy to construct and cost effective."

Other projects are also planned for the Titanic Quarter and the local press have predicted the area may eventually develop into a hi-tech orientated sector, similar to Paris's La Défense.

Above: One of the college's two cranked wings overlooked by Samson and Goliath, Harland and Wolff's famous cranes

Left: A portal frame has been added to the top of each wing

Far left: The tip or prow of the new structure

Below: Impression of the completed college in its historic nautical setting

Picture: 3D Pix

Tension structures for rare breeds

A steel frame for a new zoo visitor centre and two adjoining animal enclosures has resulted in a lighter and more cost effective project, writes Martin Cooper.

Some types of construction job do not come along very often and consequently because of their unique attributes they provide the project team with a number of unusual and ultimately fulfilling challenges. One such project is the work being undertaken at Warwickshire's Twycross Zoo, where a new visitor centre with an attached snow leopard enclosure and a wading bird sanctuary is being created.

Gone are the days when zoo exhibits were confined in bare prison-like cages with barren concrete floors, today the focus is on conservation and animal welfare, which contributes to a better environment for all, including the all important fee paying visitor.

The Twycross Himalaya visitor centre will combine a 300-seat restaurant, retail space, administration offices and ticketing booths with a 50m-long glazed elevation looking out on an enclosed Himalayan landscape replete with two rare snow leopards. On the opposite side, the new centre will also feature a function room for conferences and events overlooking a naturalistic wetland aviary for wading birds.

To enhance the snow leopard enclosure's authentic Tibetan mountain scenery, it will contain a 7m-high landscaped embankment featuring a waterfall and typical fauna, while the feline's indoor shelter – where the animals will have some privacy away from visitor's prying eyes – will be designed to mimic a Himalayan retreat.

"Projects like this don't come along very often," says Adey Steel Contracts Manager Eric Gaunt. "However, since starting this job we have also completed another tension structure housing an aviary in France."

Not that Mr Gaunt envisages Adey Steel being pigeon-holed into this niche market, but with many zoos expanding their exhibits to include more animal-friendly and naturally landscaped enclosures, he thinks this could turn out to be an expanding sector.

Main contractor Kier Marriott has been working on a 48 week design and build programme since March and the £6.7M project is scheduled to open in time for the busy Easter period.

Timescale is obviously important on this project, but a number of other factors came into play during the design stage. Initially the main visitor centre was to be a concrete framed structure, but once the job got to the tender stage, budgetary constraints meant the plans were revised with a steel framed solution being chosen.

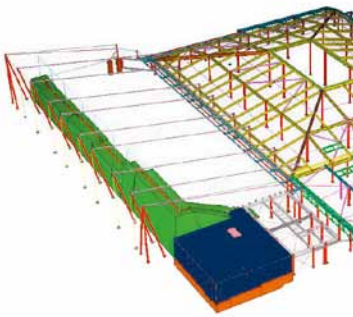
Phil Lloyd, Director for Lloyd Cullen, explains: "We proposed a steel frame with a smaller 8m x 8m grid pattern with an attached two storey plant area, as opposed to two separate plant rooms, and slightly reduced the building's overall height by half a metre. This resulted in a more efficient structure which was also quicker to erect."

A lighter steel frame also had the knock-on effect of contributing to less groundworks as a cheaper and less time-consuming foundation methodology was used. A concrete frame would have needed piled foundations, but the steel frame sits on pad foundations – which are quicker to install – and a suspended ground floor slab.

Steel erection began with the two-storey plant building, which is a beam and column structure with a footprint measuring 15m x 20m.

"This is a heavily braced box and by erecting this first it provided the stability for the remainder of the visitor centre," explains Mr Gaunt. "It's also the part of the project furthest from the access point, so it meant we were never in danger of being hemmed in."

Once the plant area had been erected the adjacent single-storey administration area was built

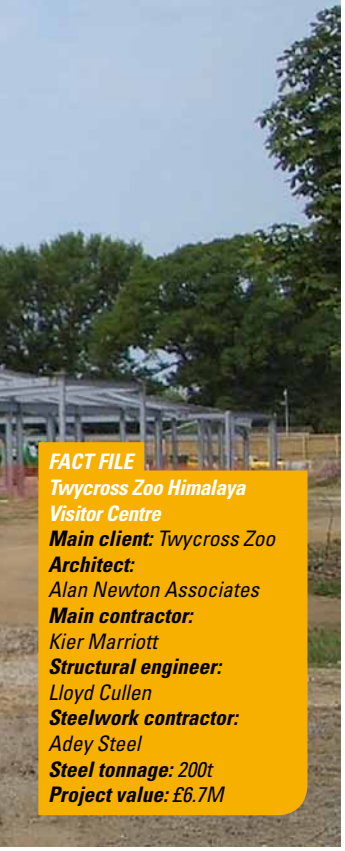


Top: The two storey braced plant area was first to be erected, providing stability for the rest of the structure

Above: Model showing the visitor centre with the leopard enclosure on the left and the bird enclosure on the right

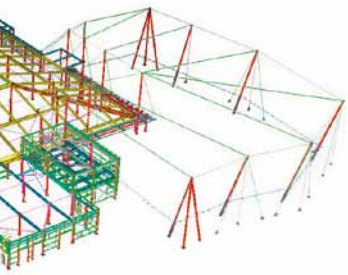
Right: CHS columns support the enclosure's netting

Below: The snow leopard enclosure and its 7m high embankment which will feature a waterfall



FACT FILE
Twycross Zoo Himalaya Visitor Centre
Main client: *Twycross Zoo*
Architect:
Alan Newton Associates
Main contractor:
Kier Marriott
Structural engineer:
Lloyd Cullen
Steelwork contractor:
Adey Steel
Steel tonnage: *200t*
Project value: *£6.7M*

Above: The vistor centre features a 50m long viewing window which looks out into the Himalayan snow leopard enclosure
Below right: One of the soon to be housed Himalayan snow leopards



followed by the main visitor centre structure.

Although based around a regular grid pattern the visitor centre features some intricate geometry as the roof pitches in two directions and the two enclosures, situated along three elevations, bring additional loadings to the steel frame. To accommodate these loads some columns have had to be moved, making the grid pattern slightly irregular. The visitor centre is also heavily braced, both vertically and horizontally.

The steel frame sits on pad foundations – which are quicker to install.

"High axial loads imparted onto the main frame from the netting enclosures and the frame geometry itself made the connection design process especially challenging," says Mark Whelband, Adey Steel Design Manager.

Every corner of the visitor centre structure has a different steelwork configuration because of the associated loads and the hipped and square cantilever soffits which run along each of the elevations. A high degree of attention to detail was employed by Adey to ensure that all of the critical interfaces, such as CHS enclosure columns, tie bars, tension cables, netting, glazing, cladding and external gabion walls all worked as intended.

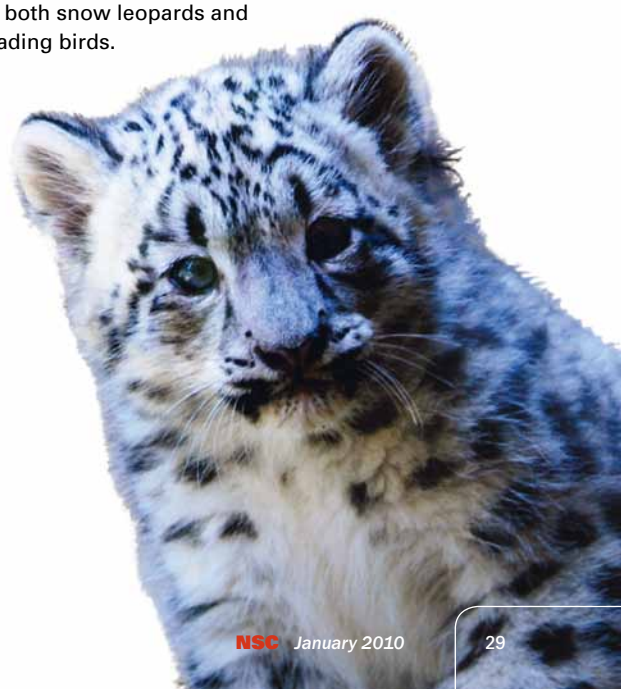
"Our designed and detailed structural netting connections to the interfacing building perimeters being a typical example," adds Mr Gaunt.

Metal decking has been installed to the centre's pitched roof as its green sedum covering needed a flat surface. The composite deck's diaphragm action together with a 50m-long roof girder, installed parallel to the enclosure's window, transfers the loads from the leopard enclosure to the structure's vertical bracing.

Steelwork for the main visitor centre was completed in May and Adey then returned to site in September to erect the two enclosures. "An early decision was taken to form splices at all of the tubular guy cable supports in order to facilitate the earliest installation of the main frame thereby enabling early access for follow-on trades while our detail design of the enclosure structures continued," explains Mr Gaunt.

The two enclosures were always designed as steel elements, with both tension structures primarily constructed with 13m-high CHS columns. The more heavy duty leopard enclosure features stainless steel and galvanised guy cables supporting a flexible stainless steel woven mesh netting. The wading bird enclosure is a similar structure, albeit with a lighter nylon multi-filament yarn mesh netting used as a covering.

Everyone involved with this project agrees that it is a unique and rewarding job. Complex geometry and unusual loadings have been overcome to provide Twycross Zoo with an impressive structure featuring exhibits that will give visitors an opportunity to experience the real-life environment of both snow leopards and wading birds.



Bridging the new road to Bedford

Steel has proven to be the most cost effective and efficient solution for the construction of seven bridges along the new A421 dual carriageway in Bedfordshire.

The A421 between M1 Junction 13 and the Bedford Southern Bypass is being replaced with a new highway currently under construction slightly to the north of the existing road.

Largely single carriageway, this stretch of the A421 regularly accommodates 25,000 vehicles per day leading to considerable congestion, particularly during peak hours.

"This high volume of traffic results in a poor accident record as there are few overtaking opportunities and a major reduction in the quality of life for local residents," comments Roy Brunsden, Project Manager for the Highways Agency.

To alleviate these problems a brand new 13km long section of the A421 is being constructed, featuring dual two lane and three lane carriageways and with road crossings being replaced with bridges.

After considerable local consultation as to where best to position the new road – avoiding local communities as well as old brick pits which litter the surrounding countryside – the project started on site in October 2008.

The project team, which includes main contractor Balfour Beatty, designer Scott Wilson and consultants Jacobs, put a lot of time and effort into ensuring the new highway not only fits in with the local topography, but more importantly had the fewest number of junctions possible.

The existing A421 has a number of small roads crossing it and all of these will have a dedicated bridge over the new highway. Meanwhile at Junction 13, a remodelling of the traffic layout is taking place, whereby the new A421 will cross the motorway via a new bridge, avoiding the busy junction 13 altogether and linking into the existing A421 dual carriageway, west of the M1, for Milton Keynes.

"Most commuters travelling west along the A421 don't need to use Junction 13 for the M1 as they are going to Milton Keynes. By taking the new road off the junction we'll make it less busy, while new roundabouts will link the M1 motorway with the new A421," explains Phil Clifton, Project Director for Balfour Beatty.

Value engineering came to the fore when deciding on how to construct the 14 bridge structures required along the route of the new highway.

"Cost, quality and ease of construction were of major importance and so we decided that all of the longer span structures – over 30m long – would be built with steel," says Mr Clifton. "With steel there is a more efficient sequencing of work, less working at height and they are also quicker to erect as we can bring larger pre-assembled sections to site."

Value engineering also resulted in steelwork contractor Mabey Bridge being awarded the contract to fabricate, supply and erect seven instead of six bridges. One structure's design being changed from concrete to steel as it was deemed more cost effective and quicker to construct.

The other bridges along the route, all carrying minor roads, will be constructed with precast and insitu concrete, while a footbridge is to be built as a warren truss structure and fabricated and erected by another steelwork contractor, Nusteel Structures.

The largest and one of the first bridges to be erected on the project was the Brogborough Bridge which is the most easterly structure of the project and will take the new A421 over the M1. Designed to carry four lanes of traffic over one of the UK's busiest motorways, the steel erection for the bridge deck was completed during five night time partial closures.

The Brogborough Bridge is 62.5m long with a

Above: The Brogborough Bridge over the M1 is the project's largest bridge

FACT FILE
A421 Improvements Scheme
Main client: *Highways Agency*
Main contractor: *Balfour Beatty*
Designer: *Scott Wilson*
Consulting engineer: *Jacobs*
Steelwork contractor: *Mabey Bridge (Fairfield Mabey)*
Steel tonnage: *1,000t*
Project value: *£202M*

concrete central pier and concrete abutments, which were completed earlier in the programme. Girders of this length were too long to bring to site in one piece so the bridge was erected with eight braced pairs of girders, four for each side of the central pier with a 3.5m spacing between each pair.

"The structure has been designed to allow for an air joint directly over lane three of the northbound carriageway. This allowed the 38m long girders over the southbound carriageway to be erected over a series of road closures, followed on by further closures of the northbound carriageway to erect the balance of the structure," explains Andrew Hosking, Mabey Bridge Project Manager.

The erection sequence, using one 250t capacity mobile crane, involved erecting one pair of braced girders on the first night.

"Once the initial 38m-long braced pair was up over the southbound carriageway, we had something to attach the subsequent girders to," says Mr Hosking. "The following night we erected one more pair over the southbound cariageway followed by the last two pairs the next night."

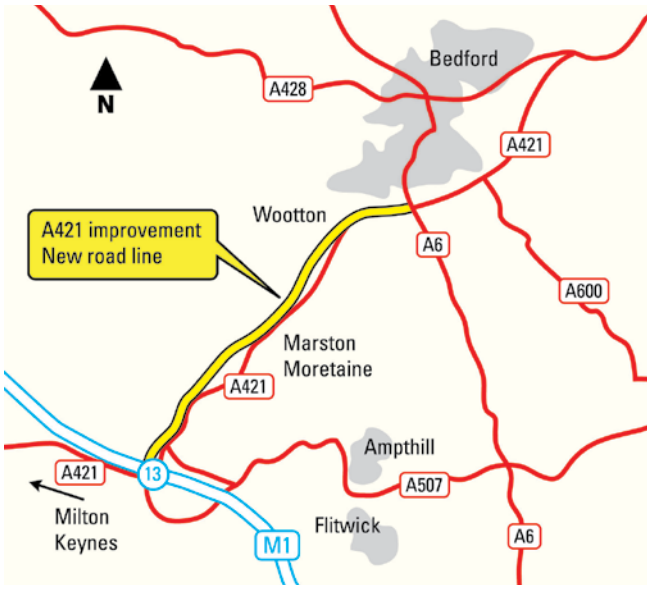
A similar lifting procedure was then conducted over the northbound carriageway over the next two nights.

With value engineering being paramount to the overall success of the scheme, the weight of the Brogborough structure was reduced from 369t at tender stage to 255t. "This was a credit to all involved and a considerable cost saving," adds Mr Hosking.

Commenting further on the lifting procedure, Mr Clifton says: "As all of the girders were brought to site in braced pairs no on-site assembly was necessary and they were lifted into place quickly with minimal disruption to the M1. Bearing in mind our partial closures only lasted from 10pm until 5am and we needed at least one hour to rig and then di-rig the crane, everything went to plan."

Since completing the steel erection of the Brogborough bridge, the slab has been cast, using 400m^3 of concrete.

Works commenced in late August with the erection of the Fields Road North structure. During October two other bridges were erected along the route, Salford Road and Wood End with the Vale Farm Bridge being lifted into position early November. The first two structures carry minor roads across the new A421, while Vale Farm is a non-vehicular bridge consisting of two 35m-long girders lifted individually and then braced up in-situ.



Salford Road was erected over a couple of days and is made up of seven 35m-long girders spaced at 3.85m, while Fields Road is a smaller structure requiring only four 33m-long girders.

"The bridges are not being erected in any geographical sequence," says Mr Clifton. "There are major works all along the 13km project route and once the earthworks, foundations and abutments are ready each bridge is erected. By using steel on all the longest bridges the erection process is then quick and easy with less working at height as the girders come to site fully assembled."

One of the other aspects of this major civil engineering project is the earthmoving. More than 800,000m^3 of overburden is being removed to form two large cuttings near Marston Moretaine, about half way along the route. None of the earth is leaving the site, all of it being transported by a fleet of 40t capacity trucks to other parts of the project for in-filling or to form embankments.

The remaining two steel bridges, Marston Junction and Manor Farm, will be erected in early December and January respectively by Mabey Bridge. The new A421 will open at the end of 2010.

Below: All of the bridges of 30m or longer are being built with steel

Bottom: Erecting a bridge over the M1 required a number of night time road closures

Modified CTRL paint system debuts on road project

The Highways Agency has specified that all steel bridges along the new A421 are painted with a zinc based system as opposed to a traditional aluminum metal spray coating. Previously trialed on steel structures for the Channel Tunnel Rail Link (CTRL), the system is said to be a cost effective alternative to the aluminum metal sprayed systems with a greater ease for application in both the works and on site.

An additional modification and subsequent departure from the standard CTRL system was to eliminate the use of aluminum on all elements of the structure. Where as the standard CTRL system allows for aluminum metal spray to the outer surfaces of jointed area this was replaced with a shop applied zinc epoxy primer.

The only painting to be completed on site will be areas around the bolted joints as all other items are applied with a full system at Mabey Bridges' facility in Chepstow after completion of the fabrication process.

"As well as being a low maintenance system, requiring infrequent repainting, the system has a blue hue and aesthetically was right for the project," explains Mr Brunsden.

The carbon footprint of steel

How the embodied carbon content of steel should be calculated using the system expansion method which is widely regarded as the most comprehensive formula.

To accurately establish the environmental impact of steel manufacture, the World Steel Association (Worldsteel) uses the 'system expansion' method of life-cycle assessment. This is the most comprehensive assessment method currently available and is the preferred approach of the ISO 14040 series of environmental standards. The values in Table 1 have been derived from an extensive dataset collected by Worldsteel using the 'system expansion' method.

	Plate	Sections	Tubes	HDG	Purlins & rails
CO_2 (tonnes per tonne of steel)	0.919	0.762	0.857	1.350	1.100
Energy (GJ per tonne of steel)	17.37	13.12	15.42	21.63	19.38

Table 1: Carbon and energy impacts of steel products

It is standard practice to express carbon and energy impacts on a per tonne basis, which can give the false impression that steel has higher impacts than other construction materials. However, steel has a high strength-to-weight ratio, which means that the weight of steel required, for a given application, is often much less than for the alternatives.

There are other values in circulation from a variety of sources. Some are higher and some are lower than those quoted in Table 1. They are often derived from limited 'cradle to gate' analysis that consider the first manufacture and use of a product, but ignore the impacts or benefits associated with the treatment of a product at the end of its life.

Highly recycled materials, such as metals, are penalised by a simplified 'cradle to gate' analysis, whereas materials that are predominantly disposed of as waste at the end of their first life, such as timber, can be advantaged. This is clearly contrary to environmental good practice. The 'system expansion' method considers the full product life-cycle from 'cradle to grave'.

Calculation of the Carbon Dioxide emissions associated with steel production

The 'system expansion' method credits manufacturing processes for co-products that save energy and emissions, such as process gases being used to generate electricity. Credit is also given for the net CO_2 that is saved when a product is reused or recycled.

Steel is manufactured predominantly using two methods. Both methods of production require a significant input of scrap steel. The primary route uses 13.8% scrap, with emissions of 1.987 tonnes of CO_2/tonne of steel. The secondary route uses 105% scrap steel, with emissions of 0.357 tonnes CO_2/tonne. From these basic figures it is possible to calculate the tonnage of CO_2 that is saved for each tonne of scrap steel that is recycled.

CO_2 saved = (1.987 – 0.357) / (1.05 – 0.138)
= 1.787 tonnes CO_2 / tonne of scrap

We can now calculate the CO_2 emissions associated with the production of a tonne of steel, independently of the production route. Using two scenarios demonstrates that the CO_2 emissions for

Summary

- The carbon footprint of steel is derived by the system expansion method
- The system expansion method is the preferred approach of ISO14040
- Part of steel's clearest environmental benefit occurs at end of life with virtually guaranteed recycling or reuse. Other materials need careful end of life management to realise limited benefit.
- Most carbon footprint calculations use cradle to gate data which does not take account of the full life cycle
- The values in Table 1 are derived by system expansion from an extensive dataset
- Carbon and energy impacts are traditionally expressed on a per tonne basis
- Because of its high strength-to-weight ratio, the weight of steel required, for a given application, is generally much less than the weight of alternative materials
- Steel is a highly recycled (multicycled) material via an established infrastructure in a self sustaining loop not dependent on artificial precautions or dedicated effort
- Specifying by 'recycled content' works for materials generally sent to landfill, but it does not increase recycling rates for steel. However, it may introduce unnecessary transport costs and emissions

	Scenario A	Scenario B.
Average proportion of scrap in the steel	(105+13.8)/2 = 59.4%	105%
Average CO_2 emissions / t	(1.987x0.5)+(0.357x0.5) = 1.172 t / t	0.357 t / t
Net scrap produced through product life-cycle	99% - 59.4% = 39.6%	99% - 105% = -6% (some is lost)
CO_2 emissions / t	1.172 – 0.396 x 1.787	0.357 - (-0.06x1.787)
	= 0.464 t / t	**= 0.464 t / t**

Table 2: Scenarios for proportions of primary and secondary sourced steel

	Sections	Purlins & side rails	Cladding	Composite floor decking
Recycled (%)	86	89	79	79
Re-used (%)	13	10	15	6

Table 3: End-of-Life recycling and re-use rates for steel products

steel are the same irrespective of the proportions of primary and secondary sourced steel assumed.

- Scenario A – assume the market sources 50% of its steel from primary production and 50% from secondary production

- Scenario B – assume the market sources 100% of its steel from secondary production

In both scenarios, the same end-of-life recycling rate is used. In this case 99%, which is the value that has been demonstrated by research for steel sections in the UK.

The results in Table 2 demonstrate that the impact of steel manufacture is identical regardless of the level of recycled content. These results relate specifically to the production of steel slab for further processing into steel sections. This will vary for different products depending on the recycling rate for the particular product in question (see Table 3).

When the impacts of rolling and formation of the final product are added to those for slab manufacture, the total CO_2 emissions for various steel products are shown in Table 1. The steel industry is committed to environmental and energy improvement so these values will reduce as process improvements are implemented.

Advances in structural applications of stainless steel

Stainless steel is suitable for a wide range of structural elements where strength, ductility, durability, appearance and low maintenance are required. SCI's Nancy Baddoo describes some new developments in structural applications of stainless steel.

Applications using duplex stainless steel grades

Structural applications of stainless steel have generally used austenitic grades: types 1.4301/1.4307 for rural, urban or lightly industrial environments and types 1.4401/1.4404 for heavily industrial or marine environments. The use of duplex stainless steels is relatively new to the construction industry although they have a long track record in the petrochemical and pulp and paper industries. These alloys have high strength (design strengths around 450 N/mm^2) and ductility (>20%) with good weldability and formability. They have tremendous potential for expanding future structural design possibilities, enabling a reduction in section size and leading to lighter structures. A range of open and closed structural profiles are available in duplex grades. Design guidance can be found in the *Design Manual for Structural Stainless Steel* [1] and updated guidance on fabrication has just been published [2].

Duplex grade 1.4362 was used for the arches of the Celtic Gateway footbridge in Holyhead, Wales, which was opened in 2006. This grade has a corrosion resistance similar to that of austenitic grade 1.4401 and twice the design strength. The more highly alloyed duplex grade 1.4462 was used for the arch of the Millennium Bridge in York and the first stainless steel road bridge, built in Menorca in 2005 (Figure 1). This grade displays superior corrosion resistance, especially to stress corrosion cracking.

High nickel prices have more recently led to a demand for 'lean' duplexes with very low nickel content, such as grade 1.4162. The corrosion resistance of grade 1.4162 lies between that of 1.4301/1.4307 and 1.4401/1.4404. Due to its low nickel content of 1.5% (typical stainless steels have >3%), it is an economical alternative to other austenitic and duplex grades whilst also experiencing lower price volatility. One of the earliest structural applications of this grade was a footbridge with a 120 year design life in the suburb of Ruffolo, Siena in Tuscany. The cable stayed bridge spans 60m over a busy motorway and was completed in 2006 (Figure 2). Lean duplex 1.4162 was used for the pylons and load carrying longitudinal and transverse beams.

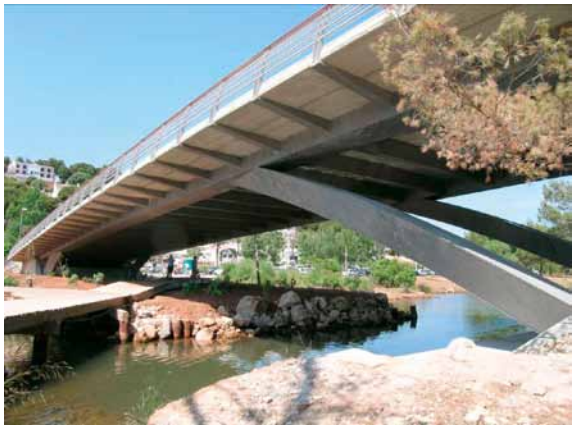


Figure 1: Cala Galdana Bridge, Menorca (Photo: Pedelta)

Figure 2: Ruffolo Footbridge in Siena, Italy (Photo: Outokumpu)

Exploiting the distinctive properties of stainless steel

The structural performance of stainless steel differs from carbon steel because stainless steel has no definite yield point and shows an early departure from linear elastic behaviour with strong strain hardening. The shape of the stress-strain curve in the plastic range ensures higher plastic moment resistance than carbon steel of equivalent strength. Stainless steel is therefore an ideal material for

explosion-resistant structures because it has high strength, good energy absorption characteristics and high ductility. An additional advantage when considering blast resistance is that the strain-rate sensitivity is more pronounced in stainless steels than in carbon steels with a proportionally greater strength realised at fast strain rates for stainless steel than for carbon steel, particularly in the region of the 0.2% proof strain.

The strength and stiffness retention characteristics of stainless steel at elevated temperatures also differ from carbon steel. Austenitic stainless steels show superior strength retention properties above temperatures of around 550°C and superior stiffness retention at all temperatures. Retention factors for the key grades of stainless steel are reported in the *Design Manual for Structural Stainless Steel* [1].

The combination of resistance to fire and blast coupled with exceptional durability has led to many structural applications in the oil and gas industry. Stainless steel grade 1.4401 was chosen for the fire and blast rated cladding for four new accommodation modules and two walkway modules installed earlier this year on BG Group's Armada Platform in the Central North Sea. The cladding, formed from corrugated sheet 80mm deep and 2mm thick, is designed to resist blast pressures of 110 millibar.

Figure 3: Installation of stainless steel accommodation modules on the Armada Platform (Photo: Mech-Tool Engineering)

Hot rolled and welded stainless steel sections

There is no standardised family of sizes for stainless steel structural sections. Hollow sections are available in a wide range of sizes, with each manufacturer tending to stock its own range. Channels and angles tend to be produced by roll forming (rolling or bending) and are frequently made to order. The availability of hot rolled and laser welded I sections is increasing.

In 2003, SCI developed web-based design software for cold-formed stainless steel members such as hollow sections, channels and equal angles (available on *www.steel-stainless.org/software*). The software calculates section properties and member resistances for user-defined sections. It aligns to the Eurocode for structural stainless steel [3] and includes a fire resistance design facility that estimates how quickly a section will heat up in standardised fire situations and its reduced resistance after exposure to the fire.

With sponsorship from the Swiss section manufacturer Montanstahl, the design facility has now been extended to cover a range of laser fused and hot rolled structural sections (I sections, T sections, equal and unequal angles). Additionally, an online section database has been incorporated so that users can select a particular section from the Montanstahl range for use in the design software (Figure 4). It is intended that the database will be extended further to include sections from other manufacturers.

Figure 4: Software for designing stainless steel sections (www.steel-stainless.org/software)

Although a US specification dealing with the structural design of cold formed light gauge stainless steel has been available for many years, there is no US design standard covering heavier sections in stainless steel. Work is underway at SCI on an AISC Design Guide for hot rolled and welded stainless steel structural sections. The guidance will be in accordance with US philosophy and aligned to the principles of the AISC Steel Construction Manual. It is hoped that the availability of this design guidance will facilitate greater and more efficient use of hot rolled and welded steel in the US, and other countries such as China which use US design standards.

Model specification for fabrication and erection

Unintended over-specification by the designer, such as requiring an architectural surface finish for a structural component where visual appearance is not important, can lead to unduly high fabrication and installation costs for stainless steel fabrications. To overcome this problem, SCI are working with Arup to prepare a model specification for structural stainless steel which aids the specification of appropriate standards for surface finish, joining, fabrication, erection, installation, inspection, maintenance and cleaning. The scope of the specification will be limited to building construction, although further versions could cover other forms of construction such as bridges. The specification will align to the new European fabrication and erection specification EN 1090-2 [4].

Use of a stainless steel model specification will lead to greater uniformity in structural steelwork contract specification, and thus help to achieve more cost effective stainless steel structures. The specification will be prepared in such a way that it is suitable for incorporation within the forms of contract normally employed in the steel construction industry. It will be available as a downloadable Word file so that specifiers can customise it to suit their particular project requirements.

References

[1] Design Manual for Structural Stainless Steel (with design examples and a background commentary, available in seven languages), Euro Inox and The Steel Construction Institute, Third Edition, 2006 *www.steel-stainless.org/designmanual*

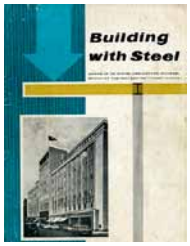
[2] Practical Guidelines for the Fabrication of Duplex Stainless Steels, International Molybdenum Association, 2009

[3] EN 1993-1-4:2006 Eurocode 3. Design of steel structures. General rules. Supplementary rules for stainless steels

[4] EN 1090-2:2008 Execution of steel structures and aluminium structures. Technical requirements for the execution of steel structures

Building with Steel, the BCSA's *'informative journal relating to the progress of and developments in the Constructional Steelwork Industry'* was first published in February 1960. Here's how the magazine reported developments up to that point in its introductory article…

Background to steel as a structural medium



A LONG HISTORY

From the time the first large bridge was built in steel in 1890, when the Forth Bridge was completed using 51,000 tons of steel and 6½ million rivets, many famous bridges have been supplied from this country and erected in all parts of the world.

The first recorded example of a completely steel-framed building in Britain was a warehouse building constructed at Stockton-on-Tees in 1898, although a twenty-one storey building with a steel frame, then claimed to be the tallest in the world, was built in Chicago in 1892.

The Ritz Hotel is recorded as the earliest steel-framed building in London, being designed by the late S. Bylander and built from 1904. From that time onwards the use of steel-frame construction was a regular feature of all large buildings throughout the country and there were relatively few prominent structures built prior to the 1939/45 war which did not depend upon a steel framework for support. The behaviour of many of these buildings during wartime showed the merits of this form of construction.

STEEL SHORTAGES

Wartime conditions, however, also led to acute steel shortages, and it became necessary for the Government to urge ways and means whereby steel could be conserved for essential purposes of war.

Much thought and Government encouragement were given to developing alternative forms of frame construction and staffs which were versed in the design of steelwork gave place to those who were trained in the use of more readily procurable materials.

The wartime steel shortage continued to a greater or lesser degree until 1957 since when it has been possible to procure steelwork within a period regarded as reasonable in pre-war days. Not only has the supply position improved, but in the last eighteen months there have been significant reductions in the cost per ton of fabricated steelwork.

COSTS

Much has been said in recent years on the subject of comparative costs of alternative forms of framework for multi-storey buildings but it rarely happens that strict comparisons are possible.

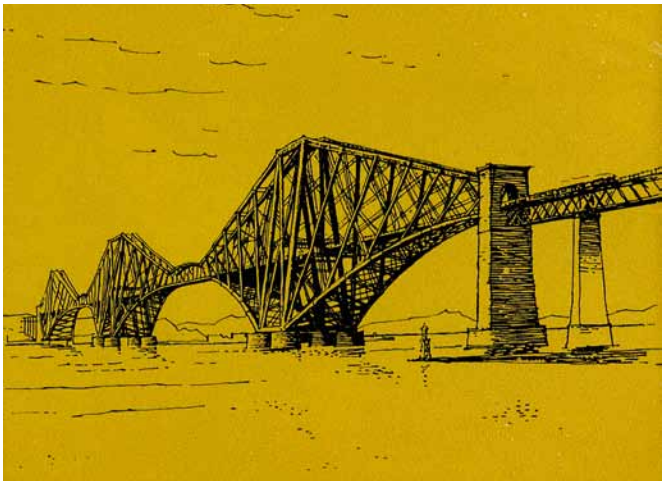
Recent research and experience suggest that significant savings both in cost and time can be effected by the use of other than concrete fire encasement which is an important element of the cost of multi-storey construction. Hollow fire encasements in vermiculite or asbestos are being increasingly used and show advantages in many ways.

The recent introduction of universal beam sections, rolled in this country only since 1958, provides the means of saving weight and cost owing to the more efficient use of steel and the reduced amount of workmanship these sections normally entail.

The ready availability of high-tensile steel gives the designer great opportunities to reduce the weight of steel required for a given purpose, with the knowledge that all material has been rigorously tested throughout its manufacture, whilst the quality of the workmanship remains open for inspection.

CHOICE OF CONSTRUCTION

The use of high-tensile steel in no way affects the choice as to whether riveted or welded construction should be adopted. High tensile steel to B.S.968 can be welded as readily as mild steel, whilst the use of notch ductile steels in welded structures presents no difficulty in cases where the use of the somewhat more expensive type of steel is warranted.



An artist's impression of the Forth Bridge

There has been considerable progress in both the total tonnage and size of shop welded structural members, individual girders in excess of 100 tons in weight being by no means unusual. The use of welded girders to carry moving loads in structures such as crane gantries and railway bridges has for many years proved highly satisfactory both in appearance and in service.

The clean outline and plain surfaces of welded construction have attraction; perhaps it is in the field of portal construction where this is most apparent. Single-storey sheds in this form provide buildings in which almost all of the enclosed space can be used, and there are no roof trusses to encroach upon the space above the eaves level.

THE PLASTIC THEORY

Structural design has benefited greatly from the research of Prof. J. F. Baker of Cambridge University into the behaviour of structures and his development of the Plastic Theory. This method of design leads to lighter structures and the range of buildings to which it can be applied has been and will be greatly extended as the outcome of his great work.

THE FUTURE

The restriction of steel supplies in the post war period adversely affected its use for bridge work and led to an increased adoption of reinforced and pre-stressed concrete for the shorter spans. Adverse comments upon the heavy appearance of some of these structures and the more competitive position of steel construction from the point of view of both price and speed of erection should lead to a reaction in its favour.

During the past two years there has been a great revival of interest in bridge construction. Work is now proceeding on the great Forth bridge project, upon the Widnes-Runcorn and Tamar bridges, both of over 1,000 ft. span: also upon a number of viaducts incorporating medium span river crossings in connection with new motor roads, particularly in the north. All of these are of steel construction.

The industry remains active in work overseas, usually in the face of keen international competition. Major steel bridges have been constructed by British builders in India, Siam and Malaya, Ghana and Nigeria, Egypt and Iraq, Australia and New Zealand, Portugal and Iceland.

The development of motorways and modernisation of the railways will inevitably involve the construction of many new bridges and the replacement of existing ones. These developments offer great prospects for the structural steel industry.

Perronet Thompson School, North Bransholme

For: Humberside County Council

Architects:
Property Services Department, Humberside County Council
Structural Engineers:
Oscar Faber Consulting Engineers
Steelwork Contractor:
Billington Structures Limited
Main Contractor:
John Laing Construction Limited

In 1984, a Design Team within the Humberside County Council's County Architect's Department began the task of designing a school capable of meeting the demands of the 21st century – a school of the future. The school would be in the north of Bransholme, one of the largest local authority housing estates in Britain.

It was considered essential that the new school should form an active part of the community. A community element would assist the agreed design objective, which was to provide a stimulating environment so that pupils would relish going to school instead of regarding it as a place of repression. The complex was therefore designed to give the children a feeling of identity, fertilise their imagination and prepare them to face the future with some degree of optimism.

Started in September 1986, and ready for phased operation by the autumn term of 1988, the building now sits in a greenfield site like a silvery space ship ready for take-off. Imagery such as this has been encouraged from the beginning of the design process and has found a response in the children. There is also a "Tardis" quality about the building since it contains much more accommodation than the comparatively simple external envelope would suggest. Through the involvement of the Hull City and Humberside County Leisure Services Departments, the pupils and the public will share enhanced facilities in the increased size of the library and provision of Meeting Rooms, Courtyard Tea Rooms, Multi-Gym and an enlarged Sports Hall and changing facility. Additionally, the public will be able to use accommodation provided as a normal part of the Education provision, namely the Gymnasium, Exhibition and Social area and the Drama area. This latter space is a genuine small theatre, semi circular in plan with an apron stage and retractable seating for 200.

Energy conservation is also built into the design. The building is a compact form and has a minimal external envelope, thus reducing heat loss. It is sited on a north/south axis so that each side receives an equal amount of sun and the barrel vault will therefore receive the maximum amount of sunlight. The vault has a double skin over two thirds of its length, trapping the warm air, which is ducted to other parts of the building to supplement the ordinary heating system. Heating and lighting is controlled by computerised room sensors. It is anticipated that these measures will provide savings in the region of 30% against normal fuel bills.

Building materials have been chosen to resist vandalism and reduce maintenance costs. Fairfaced blockwork is used extensively to both exterior and interior walls.

The projects shows how structural engineering not only facilitates architectural concepts but can enhance them and introduce novel techniques at the same time.

As an example, exposed blockwork keyed into steel columns provides a structural element, complements the design and meets the required half hour fire rating without fire protection. This combination has not been used before.

Judges' Comments:
In an otherwise dull landscape, this imaginative steel structure stands out as a focal point for the local populace, serving, as it does, as both school and community centre. Brightly coloured exposed castellated steel beams and columns, together with secondary steelwork, blend tastefully with the masonry and glazing to give the building a cheerful and interesting appearance which provides an exciting environment for its dual role.

AD 340
Elastic Moduli of Angle Sections

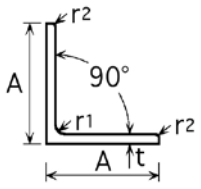
It has been drawn to our attention that the values given in AD 261 for the elastic section moduli about the v-v axis for unequal angles were in error. The values stated were greater than the correct values. The values are needed for the design of single angle sections subject to lateral torsional buckling, in accordance with clause 4.3.8.2 of BS 5950 1: 2000.

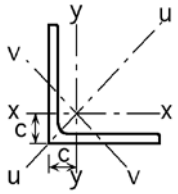
The values for equal leg angles were correct but for ease of reference, the correct values of moduli about u-u and v-v axes for both equal and unequal angle sections are presented below.

Guidance on the design of angles, in relation to lateral torsional buckling, is given in AD262.

Contact: Andrew Way
Tel: 01344 636525
Email: advisory@steel-sci.com

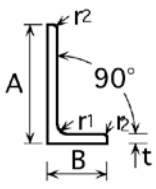
EQUAL ANGLES

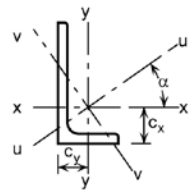




Section Designation		Elastic Modulus	
Size A x A, mm	Thickness t, mm	Axis u-u, cm^3	Axis v-v cm^3
200×200	24	373	167
	20	320	146
	18	293	133
	16	263	123
150×150	18	158	71.0
	15	135	61.6
	12	110	52.0
	10	93.3	45.3
120×120	15	83.7	37.4
	12	68.8	31.6
	10	58.6	27.6
	8	48.4	23.4
100×100	15	55.9	24.6
	12	46.4	20.9
	10	39.6	18.3
	8	32.5	15.5
90×90	12	36.9	16.5
	10	31.6	14.4
	8	26.1	12.2
	7	23.1	11.1
80×80	10	24.6	11.0
	8	20.3	9.36
75×75	8	17.7	8.10
	6	13.7	6.52
70×70	7	13.6	6.28
	6	11.8	5.61
65×65	7	11.5	4.76
60×60	8	10.9	4.87
	6	8.51	3.95
	5	7.24	3.46
50×50	6	5.74	2.60
	5	4.92	2.30
	4	4.02	1.94
45×45	4.5	3.58	1.66
40×40	5	3.04	1.38
	4	2.51	1.17
35×35	4	1.89	0.870
30×30	4	1.34	0.607
	3	1.05	0.495
25×25	4	0.911	0.399
	3	0.718	0.327
20×20	3	0.437	0.195

UNEQUAL ANGLES





Section Designation		Elastic Modulus	
Size A x B, mm	Thickness t, mm	Axis u-u, cm^3	Axis v-v cm^3
200×150	18	211	85.2
	15	179	71.8
	12	146	58.5
200×100	15	143	32.5
	12	117	26.5
	10	98.1	22.3
150×90	15	84.3	25.3
	12	69.0	20.8
	10	58.5	17.6
150×75	15	78.2	17.9
	12	64.1	14.6
	10	54.3	12.3
125×75	12	46.9	14.1
	10	39.9	12.0
	8	32.5	9.76
100×75	12	33.4	13.6
	10	28.5	11.6
	8	23.3	9.46
100×65	10	25.9	8.70
	8	21.1	7.13
	7	18.7	6.31
100×50	8	19.0	4.32
	6	14.6	3.31
80×60	7	13.0	5.27
80×40	8	11.8	2.70
	6	9.14	2.07
75×50	8	11.7	4.12
	6	9.10	3.18
70×50	6	8.23	3.16
65×50	5	6.36	2.64
60×40	6	5.67	1.98
	5	4.81	1.68
60×30	5	4.25	0.964
50×30	5	3.09	0.931
45×30	4	2.17	0.752
40×25	4	1.62	0.516
40×20	4	1.48	0.336
30×20	4	0.894	0.318
	3	0.699	0.245

New and Revised Codes & Standards

(from BSI Updates November and December 2009)

BRITISH STANDARDS

NA to BS EN 1991- 4:2006
UK National Annex to Eurocode 1. Actions on structures. Silos and tanks
No current standard is superseded

BS EN PUBLICATIONS

BS EN 1337
Structural bearings
BS EN 1337-8:2007
Guide bearings and restraint bearings
Supersedes BS 5400-9.1:1983 and BS 5400-9.2:1983

BS EN ISO 2560:2009
Welding consumables. Covered electrodes for manual metal arc welding of non-alloy and fine grain steels. Classification
Supersedes BS EN ISO 2560:2005

CORRIGENDA TO BRITISH STANDARDS

BS 2573-2:1980
Rules for the design of cranes. Specification for classification, stress calculations and design of mechanisms
CORRIGENDUM 1
Also incorporates Amendments 1 & 2

BS EN 1994-1-1:2004
Eurocode 4. Design of composite steel and concrete structures. General rules and rules for buildings
CORRIGENDUM 1

BRITISH STANDARDS WITHDRAWN

BS 5400:-
Steel, concrete and composite bridges
BS 5400-9:-
Bridge bearings
BS 5400-9.1:1983
Code of practice for design of bridge bearings
Superseded by BS EN 1337-2:2004, BS EN 1337-3:2005, BS EN 1337-4:2004, BS EN 1337-5:2005, BS EN 1337-6:2004, BS EN 1337-7:2004 and BS EN 1337-8:2007
BS 5400-9.2:1983
Specification for materials, manufacture and installation of bridge bearings
Superseded by BS EN 1337-2:2004, BS EN 1337-3:2005, BS EN 1337-5:2005, BS EN 1337-7:2004 and BS EN 1337-8:2007

BS EN 14295:2003
Welding consumables. Wire and tubular cored electrodes and electrode-flux combinations for submerged arc welding of high strength steels. Classification
Superseded by BS EN ISO 26304:2009

BRITISH STANDARDS UNDER REVIEW

BS EN 10306:2002
Iron and steel. Ultrasonic testing of H Beams with parallel flanges and IPE beams

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT

09/30206732 DC
BS EN 1991-1-4 AMD1 Eurocode 1. Actions on structures. Part 1-4. General actions. Wind actions
No current standard is superseded

CEN EUROPEAN STANDARDS

EN 10349:2009
Steel castings. Austenitic manganese steel castings

ISO PUBLICATIONS

ISO 3506-1:2009 (Edition 2)
Mechanical properties of corrosion-resistant stainless steel fasteners. Bolts, screws and studs
Will be implemented as an identical British Standard

ISO 3506-2:2009 (Edition 2)
Mechanical properties of corrosion-resistant stainless steel fasteners. Nuts
Will be implemented as an identical British Standard

ISO 3506-3:2009 (Edition 2)
Mechanical properties of corrosion-resistant stainless steel fasteners. Set screws and similar fasteners not under tensile stress
Will be implemented as an identical British Standard

ISO 3506-4:2009 (Edition 2)
Mechanical properties of corrosion-resistant stainless steel fasteners. Tapping screws
Will be implemented as an identical British Standard

Advisory Desk

AD 341
Corrigenda for P362

In the pdf copy of publication P362 Concise Eurocodes that was included on the USB stick at the Eurocode launch event on 25th November 2009, there are three small errors. The errors are only in that pdf file; all other pdf versions, including that on Steelbiz, and the printed documents have had the errors corrected.

The errors are:

- In Table 6.4, on page 54, the C_1 value for the uniformly distributed 'intermediate transverse loading' is shown as 1.17. The correct value is 1.13.
- In Table C1, page 93, the column for 'imposed floor loads' appears under the heading 'unfavourable permanent actions', when it should be under the heading 'unfavourable variable actions'.
- Also in Table C1, the value of the ψ_0 factors in the column for 'wind actions or snow loads' is shown as 0.7 and the product with the γ_Q factor as 1.05. The correct value of ψ_0 is 0.5 and thus the value of the product is 0.75. The correction must be made in four cells in that column.

Contact: Abdul Malik
Tel: 01344 636525
Email: advisory@steel-sci.com

Steelwork contractors for buildings

BCSA is the national organisation for the steel construction industry.
Membership of BCSA is open to any Steelwork Contractor who has a fabrication facility within the United Kingdom or Republic of Ireland.
Details of BCSA membership and services can be obtained from
Gillian Mitchell MBE, Deputy Directory General, BCSA, 4 Whitehall Court, London SW1A 2ES
Tel: 020 7839 8566 Email: gillian.mitchell@steelconstruction.org

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

- **C** Heavy industrial platework for plant structures, bunkers, hoppers, silos etc
- **D** High rise buildings (offices etc over 15 storeys)
- **E** Large span portals (over 30m)
- **F** Medium/small span portals (up to 30m) and low rise buildings (up to 4 storeys)
- **G** Medium rise buildings (from 5 to 15 storeys)
- **H** Large span trusswork (over 20m)
- **J** Tubular steelwork where tubular construction forms a major part of the structure
- **K** Towers and masts
- **L** Architectural steelwork for staircases, balconies, canopies etc
- **M** Frames for machinery, supports for plant and conveyors
- **N** Large grandstands and stadia (over 5000 persons)
- **Q** Specialist fabrication services (eg bending, cellular/castellated beams, plate girders)
- **R** Refurbishment
- **S** Lighter fabrications including fire escapes, ladders and catwalks
- **QM** Quality management certification to ISO 9001

Notes
(1) Contracts which are primarily steelwork but which may include associated works. The steelwork contract value for which a company is pre-qualified under 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.

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	Contract Value (1)
A C Bacon Engineering Ltd	01953 850611			●	●		●										Up to £1,400,000
ACL Structures Ltd	01258 456051			●	●	●	●				●				●		Up to £3,000,000
Adey Steel Ltd	01509 556677				●	●	●	●		●	●			●	●		Up to £3,000,000
Adstone Construction Ltd	01905 794561			●	●	●											Up to £4,000,000
Advanced Fabrications Poyle Ltd	01753 531116				●		●	●	●	●	●				●	✓	Up to £800,000
Andrew Mannion Structural Engineers Ltd	00 353 90 644 8300		●	●	●	●	●	●			●	●		●		✓	Up to £3,000,000
Angle Ring Company Ltd	0121 557 7241												●				Up to £800,000
Apex Steel Structures Ltd	01268 660828				●		●			●	●						Up to £800,000
Arromax Structures Ltd	01623 747466	●		●	●	●	●	●	●		●	●					Up to £800,000
ASA Steel Structures Ltd	01782 566366			●	●		●			●	●			●	●		Up to £800,000*
ASD Westok Ltd	01924 264121												●				Up to £6,000,000
ASME Engineering Ltd	020 8954 0028				●					●	●			●	●	✓	Up to £1,400,000*
Atlas Ward Structures Ltd	01944 710421		●	●	●	●	●	●	●	●	●	●		●	●	✓	Above £6,000,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●		●							●			Up to £2,000,000
AWF Steel Ltd	01236 457960				●				●	●	●			●	●		Up to £100,000
B D Structures Ltd	01942 817770			●	●	●	●				●			●			Up to £1,400,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●				✓	Up to £2,000,000
Barnshaw Section Benders Ltd	01902 880848												●			✓	Up to £800,000
Barrett Steel Buildings Ltd	01274 266800			●	●	●	●									✓	Up to £6,000,000
Barretts of Aspley Ltd	01525 280136			●	●	●				●	●			●	●		Up to £3,000,000
BHC Ltd	01555 840006	●	●	●	●	●	●							●			Above £6,000,000
Billington Structures Ltd	01226 340666		●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000
Bone Steel Ltd	01698 375000	●	●	●	●	●	●			●	●	●		●		✓	Up to £6,000,000*
Border Steelwork Structures Ltd	01228 548744			●	●	●	●			●	●				●		Up to £3,000,000
Bourne Construction Engineering Ltd	01202 746666		●	●	●	●	●	●	●	●	●	●	●	●		✓	Above £6,000,000
Browne Structures Ltd	01283 212720				●			●							●		Up to £400,000
Cairnhill Structures Ltd	01236 449393				●	●	●	●		●	●			●	●	✓	Up to £1,400,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●			●	●		●		✓	Up to £6,000,000
Chieftain Contracts Ltd	01324 812911			●	●										●		Up to £400,000
Cleveland Bridge UK Ltd	01325 502277	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000*
CMF Ltd	020 8844 0940				●		●	●		●	●				●		Up to £6,000,000
Cordell Group Ltd	01642 452406	●			●	●	●	●	●	●	●					✓	Up to £3,000,000
Coventry Construction Ltd	024 7646 4484			●	●	●	●		●	●	●			●	●		Up to £1,400,000
Cronin Buckley Fabrication & Construction Ltd	00 353 21 487 0017			●	●	●	●				●						Up to £6,000,000
Crown Structural Engineering Ltd	01623 490555			●	●	●	●		●		●			●		✓	Up to £800,000
D A Green & Sons Ltd	01406 370585		●	●	●	●	●	●	●	●	●	●		●	●	✓	Up to £6,000,000
D H Structures Ltd	01785 246269				●						●						Up to £200,000
Deconsys Technology Ltd	01274 521700				●					●				●	●		Up to £200,000
Discain Project Services Ltd	01604 787276				●					●	●				●	✓	Up to £1,400,000
Duggan Steel Ltd	00 353 29 70072		●	●	●	●	●	●			●						Up to £6,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●		✓	Up to £6,000,000
Emmett Fabrications Ltd	01274 597484			●	●	●	●							●			Up to £1,400,000
EvadX Ltd	01745 336413			●	●	●	●	●	●	●	●	●				✓	Up to £3,000,000
F J Booth & Partners Ltd	01642 241581			●	●		●				●				●	✓	Up to £4,000,000
Company name	**Tel**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**	**M**	**N**	**Q**	**R**	**S**	**QM**	**Contract Value (1)**

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	Contract Value (1)
Fisher Engineering Ltd	028 6638 8521		●	●	●	●	●	●	●	●	●	●				✓	Above £6,000,000
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●			●						Up to £3,000,000
Gibbs Engineering Ltd	01278 455253				●		●	●		●	●				●	✓	Up to £200,000
GME Structures Ltd	01939 233023			●	●		●	●		●	●			●	●		Up to £800,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●			Up to £1,400,000
Graham Wood Structural Ltd	01903 755991		●	●	●	●	●	●	●	●	●	●		●			Up to £6,000,000
Grays Engineering (Contracts) Ltd	01375 372411				●			●		●	●				●		Up to £100,000
Gregg & Patterson (Engineers) Ltd	028 9061 8131			●	●	●	●	●				●				✓	Up to £4,000,000
H Young Structures Ltd	01953 601881			●	●	●	●	●			●						Up to £2,000,000
Had Fab Ltd	01875 611711								●		●				●	✓	Up to £1,400,000
Hambleton Steel Ltd	01748 810598		●	●	●	●	●	●				●		●		✓	Up to £6,000,000
Harry Marsh (Engineers) Ltd	0191 510 9797			●	●	●	●				●	●					Up to £2,000,000
Henry Smith (Constructional Engineers) Ltd	01606 592121			●	●	●	●	●									Up to £6,000,000
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●		Up to £4,000,000
Hills of Shoeburyness Ltd	01702 296321									●	●				●		Up to £800,000
J Robertson & Co Ltd	01255 672855									●	●				●		Up to £200,000
James Bros (Hamworthy) Ltd	01202 673815			●	●		●			●	●	●			●	✓	Up to £2,000,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●					●		●			Up to £6,000,000*
John Reid & Sons (Strucsteel) Ltd	01202 483333		●	●	●	●	●	●	●	●	●	●		●			Up to £6,000,000*
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●						Up to £1,400,000
Leonard Engineering (Ballybay) Ltd	00 353 42 974 1099			●	●	●	●				●						Up to £3,000,000
Lowe Engineering (Midland) Ltd	01889 563244									●	●			●	●	✓	Up to £400,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●				●	✓	Up to £3,000,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●		Up to £1,400,000
Mabey Bridge Ltd	01291 623801	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000
Maldon Marine Ltd	01621 859000				●			●	●	●					●		Up to £1,400,000
Midland Steel Structures Ltd	024 7644 5584			●	●	●	●			●	●	●		●	●		Up to £2,000,000
Mifflin Construction Ltd	01568 613311		●	●	●	●	●				●						Up to £4,000,000
Milltown Engineering Ltd	00 353 59 972 7119			●	●	●	●	●									Up to £6,000,000
Newbridge Engineering Ltd	01429 866722			●	●	●	●									✓	Up to £1,400,000
Newton Fabrications Ltd	01292 269135			●	●	●				●	●	●			●	✓	Up to £4,000,000
On Site Services (Gravesend) Ltd	01474 321552				●		●	●		●	●				●		Up to £400,000
Overdale Construction Services Ltd	01656 729229			●	●		●	●			●				●		Up to £1,400,000
Paddy Wall & Sons	00 353 51 420 515			●	●	●	●	●	●	●	●					✓	Up to £6,000,000
Pencro Structural Engineering Ltd	028 9335 2886			●	●		●	●			●				●	✓	Up to £2,000,000
Peter Marshall (Fire Escapes) Ltd	0113 307 6730									●					●		Up to £1,400,000
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●		Up to £1,400,000
Remnant Engineering Ltd	01564 841160				●		●	●		●					●	✓	Up to £400,000*
Rippin Ltd	01383 518610			●	●	●	●	●									Up to £2,000,000
Roberts Engineering	01482 838240				●					●				●	●		Up to £100,000
Robinson Construction	01332 574711		●	●	●	●	●		●	●	●	●		●	●	✓	Above £6,000,000
Rowecord Engineering Ltd	01633 250511	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✓	Above £6,000,000
Rowen Structures Ltd	01773 860086		●	●	●	●	●	●	●	●	●	●		●			Above £6,000,000*
RSL (South West) Ltd	01460 67373			●	●		●				●						Up to £1,400,000
S H Structures Ltd	01977 681931						●	●	●	●							Up to £3,000,000
Severfield-Reeve Structures Ltd	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●		✓	Above £6,000,000
Shipley Fabrications Ltd	01400 231115			●	●	●	●		●	●	●				●		Up to £200,000
SIAC Butlers Steel Ltd	00 353 57 862 3305		●	●	●	●	●	●			●	●				✓	Above £6,000,000
SIAC Tetbury Steel Ltd	01666 502792			●	●	●	●				●	●				✓	Up to £3,000,000
Snashall Steel Fabrications Co Ltd	01300 345588			●	●		●								●		Up to £2,000,000
South Durham Structures Ltd	01388 777350			●	●	●				●	●	●			●		Up to £800,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●				●	●			●		Up to £400,000
Terence McCormack Ltd	028 3026 2261			●	●		●	●								✓	Up to £800,000
The AA Group Ltd	01695 50123			●	●	●	●			●	●				●		Up to £4,000,000
Traditional Structures Ltd	01922 414172		●	●	●	●	●	●	●		●	●		●		✓	Up to £4,000,000*
W & H Steel & Roofing Systems Ltd	00 353 56 444 1855			●	●	●	●	●						●	●		Up to £4,000,000
W I G Engineering Ltd	01869 320515				●					●					●		Up to £400,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✓	Up to £6,000,000
Watson Steel Structures Ltd	01204 699999	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000
Westbury Park Engineering Ltd	01373 825500	●			●			●	●	●	●				●	✓	Up to £800,000
William Haley Engineering Ltd	01278 760591			●	●	●			●	●	●					✓	Up to £2,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000
Company name	**Tel**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**	**M**	**N**	**Q**	**R**	**S**	**QM**	**Contract Value (1)**

Associate Members

Associate Members are those principal companies involved in the direct supply to all or some Members of components, materials or products. Associate member companies must have a registered office within the United Kingdom or Republic of Ireland.

1 Structural components
2 Computer software
3 Design services
4 Steel producers
5 Manufacturing equipment
6 Protective systems
7 Safety systems
8 Steel stockholders
9 Structural fasteners

Company name	Tel	1	2	3	4	5	6	7	8	9
AceCad Software Ltd	01332 545800		●							
Advanced Steel Services Ltd	01772 259822								●	
Albion Sections Ltd	0121 553 1877	●								
Andrews Fasteners Ltd	0113 246 9992									●
ArcelorMittal Distribution – Bristol	01454 311442								●	
ArcelorMittal Distribution – Mid Glamorgan	01443 812181								●	
ArcelorMittal Distribution – Birkenhead	0151 647 4221								●	
ArcelorMittal Distribution – Scunthorpe	01724 810810								●	
Arro-Cad Ltd	01283 558206			●						
ASD metal services - Biddulph	01782 515152								●	
ASD metal services – Bodmin	01208 77066								●	
ASD metal services - Cardiff	029 2046 0622								●	
ASD metal services - Carlisle	01228 674766								●	
ASD metal services - Daventry	01327 876021								●	
ASD metal services - Durham	0191 492 2322								●	
ASD metal services - Edinburgh	0131 459 3200								●	
ASD metal services - Exeter	01395 233366								●	
ASD metal services - Grimsby	01472 353851								●	
ASD metal services - Hull	01482 633360								●	
ASD metal services – London	020 7476 0444								●	
ASD metal services - Norfolk	01553 761431								●	
ASD metal services - Stalbridge	01963 362646								●	
ASD metal services - Tividale	0121 520 1231								●	
Austin Trumanns Steel Ltd	0161 866 0266								●	
Ayrshire Metal Products (Daventry) Ltd	01327 300990	●								
BAPP Group Ltd	01226 383824									●
Barnshaw Plate Bending Centre Ltd	0161 320 9696	●								
Barrett Steel Services Ltd	01274 682281								●	
Bentley Systems (UK) Ltd	0141 353 5168		●							
Cellbeam Ltd	01937 840600	●								
Cellshield Ltd	01937 840600							●		
CMC (UK) Ltd	029 2089 5260							●		
Composite Metal Flooring Ltd	01495 761080	●								
Composite Profiles UK Ltd	01202 659237	●								
Computer Services Consultants (UK) Ltd	0113 239 3000		●							
Cooper & Turner Ltd	0114 256 0057									●
Corus	01724 404040				●					
Corus Ireland Service Centre	028 9266 0747								●	
Corus Panels & Profiles	01684 856600	●								
Corus Service Centre Dublin	00 353 1 405 0300								●	
Corus Tubes	01536 402121				●					
Corus Wednesfield	01902 484100								●	
Daver Steels Ltd	0114 261 1999	●								
Development Design Detailing Services Ltd	01204 396606			●						
Easi-edge Ltd	01777 870901							●		

Company name	Tel	1	2	3	4	5	6	7	8	9
Fabsec Ltd	0845 094 2530	●								
Ficep (UK) Ltd	01924 223530					●				
FLI Structures	01452 722260	●								
Forward Protective Coatings Ltd	01623 748323						●			
GWS Engineering & Industrial Supplies Ltd	00 353 21 4875 878									●
Hempel UK Ltd	01633 874024						●			
Hi-Span Ltd	01953 603081	●								
Hilti (GB) Ltd	0800 886100									●
International Paint Ltd	0191 469 6111						●			
Interpipe UK Ltd	0845 226 7007								●	
Jack Tighe Ltd	01302 880360						●			
Kaltenbach Ltd	01234 213201					●				
Kingspan Structural Products	01944 712000	●								
LaserTUBE Cutting	0121 601 5000								●	
Leighs Paints	01204 521771						●			
Lindapter International	01274 521444									●
Metsec plc	0121 601 6000	●								
MSW (UK) Ltd	01355 232266	●								
MSW Structural Floor Systems	0115 946 2316	●								
National Tube Stockholders Ltd	01845 577440								●	
Northern Steel Decking Ltd	01909 550054	●								
Northern Steel Decking Scotland Ltd	01505 328830	●								
John Parker & Sons Ltd	01227 783200								●	●
Peddinghaus Corporation UK Ltd	01952 200377					●				
Peddinghaus Corporation UK Ltd	00 353 87 2577 884					●				
PMR Fixers	01335 347629	●								
PP Protube Ltd	01744 818992	●								
PPG Performance Coatings UK Ltd	01773 837300						●			
Prodeck-Fixing Ltd	01278 780586	●								
Profast (Group) Ltd	00 353 1 456 6666									●
Rainham Steel Co Ltd	01708 522311								●	
Richard Lees Steel Decking Ltd	01335 300999	●								
Rösler UK	0151 482 0444					●				
Schöck Ltd	0845 241 3390	●								
Site Coat Services Ltd	01476 577473						●			
Steel Projects UK Ltd	0113 253 2171		●							
Steelstock (Burton-on-Trent) Ltd	01283 226161								●	
Structural Metal Decks Ltd	01202 718898	●								
Structural Sections Ltd	0121 555 1342	●								
Studwelders Ltd	01291 626048	●								
Tekla (UK) Ltd	0113 307 1200		●							
Tension Control Bolts Ltd	01948 667700									●
Trailerpal Ltd	01743 446666							●		
Voortman UK Ltd	01827 63300					●				
Wedge Group Galvanizing Ltd	01909 486384						●			

Corporate Members

Corporate Members are clients, professional offices, educational establishments etc which support the development of national specifications, quality, fabrication and erection techniques, overall industry efficiency and good practice.

Company name	Tel
Balfour Beatty Utility Solutions Ltd	01332 661491
Griffiths & Armour	0151 236 5656
Roger Pope Associates	01752 263636
Highways Agency	08457 504030

Steelwork contractors for bridgework

The Register of Qualified Steelwork Contractors Scheme for Bridgeworks (RQSC) is open to any Steelwork Contractor who has a fabrication facility within the European Union.

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

- **FG** Footbridge and sign gantries
- **PG** Bridges made principally from plate girders
- **TW** Bridges made principally from trusswork
- **BA** Bridges with stiffened complex platework (eg in decks, box girders or arch boxes)
- **CM** Cable-supported bridges (eg cable-stayed or suspension) and other major structures (eg 100 metre span)
- **MB** Moving bridges
- **RF** Bridge refurbishment
- **QM** Quality management certification to ISO 9001

Notes

(1) Contracts which are primarily steelwork but which may include associated works. The steelwork contract value for which a company is pre-qualified under 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.

Company name	Tel	FG	PG	TW	BA	CM	MB	RF	QM	Contract Value (1)
'N' Class Fabrication Ltd	01733 558989	●	●	●	●		●	●	✓	Up to £800,000 *Operating under CVA*
Andrew Mannion Structural Engineers Ltd*	00 353 90 644 8300	●	●	●	●				✓	Up to £3,000,000
Briton Fabricators Ltd*	0115 963 2901	●	●	●	●	●	●	●	✓	Up to £3,000,000
Cimolai Spa	01223 350876	●	●	●	●	●	●		✓	Above £6,000,000
Cleveland Bridge UK Ltd*	01325 502277	●	●	●	●	●	●	●	✓	Above £6,000,000*
Concrete & Timber Services Ltd	01484 606416	●	●	●		●	●		✓	Up to £800,000
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*
Mabey Bridge Ltd*	01291 623801	●	●	●	●	●	●	●	✓	Above £6,000,000
Nusteel Structures Ltd*	01303 268112	●	●	●	●	●		●	✓	Up to £4,000,000*
P C Richardson & Co (Middlesbrough) Ltd	01642 714791	●						●	✓	Up to £3,000,000*
Remnant Engineering Ltd*	01564 841160	●							✓	Up to £400,000*
Rowecord Engineering Ltd*	01633 250511	●	●	●	●	●	●	●	✓	Above £6,000,000
TEMA Engineering Ltd	029 2034 4556	●	●	●	●	●	●	●	✓	Up to £1,400,000*
Varley & Gulliver Ltd	0121 773 2441	●						●	✓	Up to £2,000,000
Watson Steel Structures Ltd*	01204 699999	●	●	●	●	●	●	●	✓	Above £6,000,000

* Denotes membership of the BCSA

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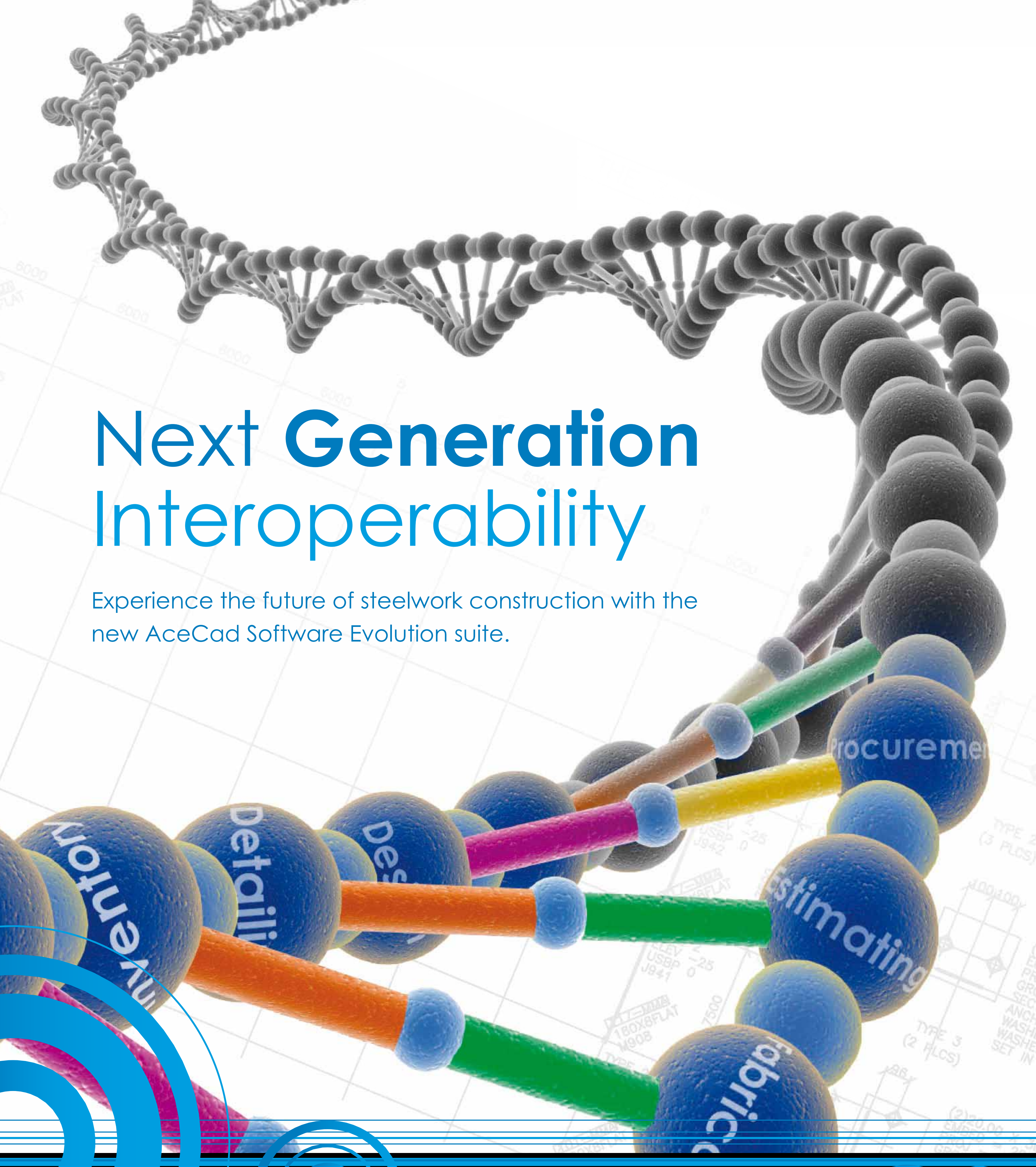

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