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NSC

Medical research in Manchester

Sept/Oct 2013
Vol 21 No.5

Sustainability marks City structure

Steel brewhouse for Guinness

Paul Westbury profile

Steel links Bangor

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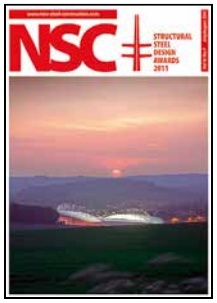








New Steel Construction keeps designers and contractors abreast of all major steel construction related developments and provides detailed technical information on key issues such as the introduction of the Eurocodes. NSC will be the first place most people hear about advances made by the extensive research and development efforts of the steel construction partners – Tata Steel, the British Constructional Steelwork Association, and the Steel Construction Institute, as well as other researchers.

Each issue of NSC is a blend of project reports and more in depth technical material. Taking up our free subscription offer is a guarantee that you will be alerted to significant developments in a sector that retains a commitment to continuous development in knowledge and techniques for timely delivery of cost effective, quality projects across all sectors of construction.

Each issue of NSC is typically 44 pages and contains four pages of news, developments related to Eurocodes, cutting edge project reports from site, and the latest technical updates from the Steel Construction Institute in its Advisory Desk Note series. One of the most popular features is 50 Years Ago, looking at key projects of the past by revisiting the pages of 'Building With Steel'.

NSC is available free of charge every two months to subscribers living in the UK or Ireland by contacting us by email at *admin@newsteelconstruction.com*, or filling in the form below and faxing it to 020 7747 8199.






You can fill out this form and fax it to **020 7747 8199**,
or scan and email it to **admin@newsteelconstruction.com**

Name

Position

Company

Address

Postcode

Telephone

Email

Cover Image
6 Bevis Marks, London
Main client: Bevis Marks Development
Architect: Fletcher Priest Architects
Steelwork contractor for main frame: William Hare
Steelwork contractor for sky garden: Tubecon
Steel tonnage: 2,200t

NSC

September/October 2013 Vol 21 No 5

These and other steelwork articles can be downloaded from the New Steel Construction Website at *www.newsteelconstruction.com*

Call for entries for the 2014 Structural Steel Design Awards

Tata Steel and The British Constructional Steelwork Association have pleasure in inviting entries for the 2014 Structural Steel Design Awards.

The Awards celebrate the excellence of the United Kingdom and the Republic of Ireland in the field of steel construction, particularly demonstrating its potential in terms of efficiency, cost effectiveness, aesthetics and innovation.

The Awards are open to steel based structures situated in the United Kingdom or overseas that have been built by UK or Irish steelwork contractors using steel predominantly sourced from Tata Steel. They must have been completed and be ready for occupation or use during the calendar years 2012-2013; previous entries are not eligible.

To find out more and request an entry form visit www.steelconstruction.org/resources/design-awards or call Gillian Mitchell of BCSA on 020 7747 8121

Closing date for entries:
Friday 13th December 2013

BCSA

TATA STEEL

Fire protection design update

Nick Barrett - Editor

More is known about the performance of structural steel in fire than is known about any other material. Designers in other materials might have to be satisfied with the results of very limited furnace tests conducted a long time ago, but those using structural steelwork can be confident that the performance they expect has been proven through full scale fire testing.

Steel Construction: Fire Protection sets out the design procedure for structural steel and is being distributed with this issue of NSC and almost 100,000 copies will be distributed free through key construction magazines over the coming weeks.

The process of demonstrating fire performance of a steel framed building is simple and straightforward. The new publication is a reference aid for designers in identifying the design fire resistance period and determining the appropriate fire protection necessary to meet this requirement. Steel has a fairly consistent share of the multi storey building market of around 70%, and these are precisely the sort of structures where fire protection is a key consideration.

Fire protection is not an additional cost that has to be factored in after the steel frame has been procured; it is included in the upfront cost and is not an extra. One of the factors that have maintained steel's market leading position has been reduction in the cost of fire protection – fire protection has never been cheaper.

Advances in the science of fire protection have altered the market share of different systems. Seventy per cent of steel structures now use intumescent coatings, with some 25% of that being applied offsite, compared with less than 20% two decades ago.

The contents of the guide will form the basis of one of the presentations at the forthcoming autumn series of Steel Essentials seminars to be held in October and November in Cardiff, London, Leeds and Edinburgh.

NSC

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Tata Steel and BCSA to host essential seminars

A new series of Steel Essentials seminars has been scheduled for this autumn at venues in Cardiff, London, Leeds and Edinburgh.

The seminars provide an opportunity for designers to keep up to date with the latest information on a wide range of important topics. These include Practical EC3 Design, EC3 – the Questions Everyone's Asking, Design for Fire, Steel Grades, Sustainability, and Steel Specification and Design.

Experts from both Tata Steel and the BCSA will be speaking at the seminars, which commence in Cardiff on 15 October, with further dates in London on 22 October, Leeds on 21 November and Edinburgh on 28 November.

For more information or to register, please visit ***www.steelconstruction.info/Steel_Essentials_2013*** or see the diary section of NSC on page 9.

Blue Book available as free app

Tata Steel has launched its Blue Book app for steel section properties and member capacities for design to BS5950 or EC3.

The app is an abridged version of the electronic Blue Book, giving users access to section property and member capacity information through iPhones, iPod and iPad.

Section properties are available for the full range of Tata Steel profiles, which can be sorted by depth, weight, plastic section modulus or inertia. Member capacities are available for UKBs, UKCs and UKPFCs for effective lengths of 2m, 4m, 6m, 8m or 10m and can be sorted by buckling resistance moment or compression resistance.

Navigation is simple, as users can to swipe seamlessly between properties and capacities. A simple tab at the bottom of the screen presents data to either BS5950 or EC3.

The app can be downloaded free from the Apple App Store.

Bridge aids town's flood defences

Steelwork erection for the replacement Pansport Bridge in Elgin, Moray, which forms part of the town's £86M flood alleviation scheme, is nearing completion.

The 75m long bridge, the largest of three in the overall scheme, is a two-span arch structure with a suspended deck requiring 600t of steelwork.

The arches are constructed from fabricated plate trapezoidal boxes that provide support for the main carriageway deck via a series of cable hangers. Cantilever sections are connected to the deck on either side of the arches to provide segregated pedestrian walkways.

To minimise the number of crane lifts, the walkways have all been fabricated and transported to site in modules measuring 4.8m wide with lengths varying from 15m to 21m.

Cleveland Bridge, working on behalf of Morrison Construction, is the steelwork contractor for the project.

Test on composite beam to improve Eurocode 4

The Steel Construction Institute (SCI) along with a number of universities, including the University of Bradford, has won an EU project aimed at developing more realistic and economically efficient shear connection rules for modern long span construction.

A key part of the project is to test composite beams with degrees of shear connection that are lower than currently permitted by Eurocode 4. With this objective, a 15m span composite cellular beam will be load-tested at Bradford University in October. It has a ratio of bottom to top flange areas of 2.5 and has regular 425mm deep openings with an elongated opening at mid-span.

This is said to be the longest composite beam test ever carried out. Shear connectors are placed at 300mm intervals along the beam in the ribs of the profiled decking and the calculated degree of shear connection is 33%.

SCI will organise a seminar at Bradford to coincide with the test, and delegates will be able to witness the final load test. The Seminar is on the afternoon of 15 October. Members wishing to take part in the Seminar are invited to contact Prof Mark Lawson at ***m.lawson@steel-sci.com***.

All change at New Street Station

Major changes are taking place at Birmingham New Street, the UK's busiest station outside of London.

A major redevelopment of the station is underway, work which includes more accessible platforms, a new concourse enclosed by a large atrium and a new multi-storey car park.

A shopping centre, known as Grand Central, will form a major element of the project's atrium. It will be anchored by a four-storey 23,500m^2 John Lewis store which is scheduled to top out this month (September).

Working on behalf of main contractor Mace, Severfield-Watson Structures has erected 2,850t of structural steelwork for the store.

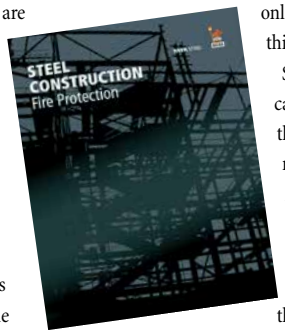
Other notable steelwork elements of the on going project include a new station façade and a series of large arched trusses that will form the main atrium.

Fire guide for the steel sector now available

All the information that architects and engineers need to know about designing for fire has been brought together in a new free technical guide from the steel sector.

Entitled *Steel Construction: Fire Protection* the guide is distributed with this issue of *New Steel Construction* and is also available as a free download from the online steel construction encyclopedia ***www.steelconstruction.info/Steel_construction_news***.

More is known about structural steelwork in fire than any other construction material. Its performance has been determined through a series of full scale fire tests, which are unparalleled for other materials.



Determining the fire protection requirements for the structural steelwork of a building is a simple and straightforward process, consistent across all types of common buildings. The procedure is clearly set out in the guide, which is intended to be a reference aid for designers at all levels.

While it is a standalone document, it also points the designer to the wealth of online articles available on this topic.

Steel frames consistently capture a market share in the multi-storey non-residential buildings market of around 70% and cost advantages are often cited as a key reason in selection of the framing material. Advances in the science of fire protection by systems manufacturers have ensured that this cost continues to fall, with the cost in real terms of fire protection today lower than it has ever been.

Isaac Newton Academy added to video case study series

The Framed in Steel series of video case studies has been enlarged with the addition of the Isaac Newton Academy

Located in Ilford, east London the £30M 1,250 pupil secondary school which specialises in maths and music, opened in September 2012.

A number of reasons contributed to steelwork being used as the project's framing solution, such as speed of construction, the number of long spans within the buildings and the material's economy of construction.

A particularly challenging part of the design was the dynamic loading in the sports hall, where the long span steel beams were designed to minimise floor vibrations.

Thermal mass is utilised within the school via exposed precast slabs on the steel frame, and the project has a super-insulated, high performance envelope to reduce energy demands.

The project's steelwork contractor was William Hare and the main contractor was Skanska.

The Framed in Steel video series covers notable recent steel building and bridge projects. Interviews with the participants interspersed with footage of the structure are used to describe the project in general terms encompassing the client's aims, design drivers and challenges faced during construction.

Clients, architects, engineers and contractors give their views on what each project represents for them, what is important, why steel was used and how steel helped to achieve the client's objectives.

Projects include the Walbrook Building, London; the Cooperative Group Head Office in Manchester; the Peace Bridge, Derry-Londonderry; NEO Bankside, London and the Siemens Facility, Lincoln.

The videos can be viewed at ***www.steelconstruction.info/Video_case_studies***

NEWS IN BRIEF

Three **steel construction webinars** are to be held: 26 September on the subject of pricing; 17 October on fire protection and 14 November on cost comparison. For more details visit: *www.steelconstruction.info/Webinars_2013*

The updated version of the **Eurocode Blue Book (P363)** is now available from SCI's shop *http://shop.steel-sci.com* The publication provides section property data and comprehensive tables of member resistances for S275 and S355 steel. Resistance tables are also provided for combined bending and compression, web resistance and shear resistance. All resistances are calculated in accordance with BS EN 1993.

Cleveland Bridge has won a multi million pound contract to supply the government of Sri Lanka with 210 bridges. With a total steel tonnage exceeding 3,500t, the rural bridges will be transported to the Indian Ocean island piece small and assembled on site.

The Crystal (Siemens centre) in east London has been certified as BREEAM 'Outstanding'. The steel framed building was a shortlisted project for this year's SSDA and has been described a benchmark for sustainable construction and operation.

Metsec has launched its latest version of the MetSPEC software for the design of purlins, side rails and mezzanine floor joists to the Eurocodes.

AROUND THE PRESS

Building Design
27 July 2013
Thirty pieces of silver
[University of Winchester] Steel was the only viable option for the primary structure, according to engineer Heyne Tillett Steel, because of the intense time pressure to complete the St Alphege building before the 2012 autumn term (the St Edburga phase completed early this year).

Construction News
26 July 2013
Steel chief positive on future
"Our improvements in efficiencies and diversifications are starting to pay dividends… from the dark days where we were losing money, we're now feeling a little better about it. There are chinks of light all over the place," said Billington Structures chief executive Steve Fareham.

Construction News
26 July 2013
Cricket pads finance county ground refurb
[Gloucestershire County Cricket ground] The castellated beams allow services to be passed through them, ensuring there is no impact on floor to ceiling heights while still managing to provide the 10m wide spans required throughout.

New Civil Engineer
8 August 2013
One bridge better
[Walton-on-Thames bridge] Consultant Atkins conducted the design work for the project, which features distinctive (steel) bowstring arches and it was the first structure in Surrey to have been designed using Eurocodes.

The Structural Engineer
September 2013
Design and construction of the Bulgari Hotel and Residences, London
Two 38t steel girders at Level 1 create the column free space for the restaurant at ground floor and basement B1, and for the ballroom at basements B2 and B3. The steel girders were also used during the early stages of the project to support the contractor's site office accommodation.

Olympic legacy on track in Derby

The steelwork erection for the Derby Multi-sports Arena, one of the first Olympics legacy projects to get underway since the Games, is due to be completed this month.

Using more than 700t of steel, the three-storey frame will house a main sports hall at ground level, an indoor cycling track on the first floor, fitness studios and offices on the second level, with plant and meeting rooms on the uppermost floor.

Working on behalf of main contractor Bowmer and Kirkland, Billington Structures has fabricated, supplied and erected the steelwork as well as installing stairs and terracing units.

The project is aiming to achieve a BREEAM 'Very Good' rating and is scheduled to be completed by the end of 2014.

Car park triggers town centre regeneration

A new 269 space multi-storey car park has been opened in the centre of Merthyr Tydfil as part of a wider regeneration scheme.

Designed and built by Bourne Parking (part of the Bourne Group), the three level structure was officially opened by Merthyr Tydfil County Borough Council.

The modular build programme included construction over an existing grade level car park, in addition to two raised storeys. The scheme includes 15 disabled bays and pedestrian access via two glazed feature stair cores.

The façade is lit with feature lighting providing a focal point for the new town centre. Additional features include CCTV, dedicated parent and toddler parking, card payment options and an open stairwell; making it easier and safer to park.

Nick Hayes, Managing Director at Bourne Parking said: "The car park has been designed to complement the on going regeneration of Merthyr Tydfil, as well as delivering much needed additional parking. Despite adverse weather conditions, including the heavy snow which disrupted work earlier in the year, we are pleased the building has been completed on programme. Working seven days a week and engaging with Merthyr Tydfil Council was key in meeting the completion date."

Leader of Merthyr Tydfil County Borough Council, Councillor Brendan Toomey, said: "I commend Bourne Parking and the local businesses involved for keeping on track with the programme of work despite the bad weather, which could have impacted on the expected completion date."

Galvanized steel keeps leisure centre on track

Graham Wood Structural teamed up with South East Galvanizers to complete a prestigious steelwork project in Lewisham, south east London.

More than 200t of galvanized structural steel was required for the construction of the Glass Mill Leisure Centre, which forms part of the wider Loampit Vale regeneration scheme.

The leisure facility is situated on the bottom three floors of a 27-storey apartment building. Galvanizing was required on various areas of the competition swimming pool, including various beams and columns, 26m roof trusses, sloping tubular columns, and curved tubes that forms a Brise Soleil façade.

Alan Stone, Production Manager at Graham Wood Structural, explained: "This was a fantastic project to work on, as it has seen the creation of an eye-catching and unusual sports centre, where local people can enjoy its facilities."

Historic mill to be restored with steel

Structural steel will play a significant role in the restoration and redevelopment of the world's first iron-framed building.

Situated on the northern edge of Shrewsbury, the Flax Mill Maltings comprises seven listed buildings including the iron framed Main Mill, which was built in 1797 and is said to be the forerunner of the modern high rise structure.

Work will include inserting a new steel frame into the Mill, in and around the existing structure with new floors tied to the building's cast iron and masonry.

Approximately 600t of primary steel will be used in the Main Mill and a further 250t of secondary steel and structural framing in the other buildings.

Main contractor Wates said the steel packages are currently being competitively priced in the market place.

Work is already under way and completion is set for early 2016.

Steel shapes Irish power plant

The steel frame for the Great Island combined cycle gas turbine power station in Wexford, Republic of Ireland is nearing completion.

The 460MW plant, which is due to be commissioned in 2014, will replace an existing 240MW fuel oil unit at the site.

Kiernan Structural Steel has fabricated, supplied and erected approximately 2,250t of steel for the project, including a series of 30m long x 3m deep trusses for the turbine hall's roof.

The turbine hall is 30m high and each of the structure's main columns weigh more than 9t each. The fabricated plate columns not only support the roof trusses, but also large 1,400m deep x 400mm wide

crane beams positioned 21m above ground level.

"Most of our overall steelwork tonnage has been erected in the turbine hall," said John Kiernan of Kiernan Structural Steel. "Although 400t was needed for the attached electrical building."

Main contractor for the project is Dragados Cobra Initec.

Fire seminars go live

Presentations from this year's Fire Safety Engineering seminars, hosted by Tata Steel and the British Constructional Steelwork Association, are now available online at: ***www.steelconstruction.info/CPD_Fire_Seminars_2013***

The seminars were held to educate architects and engineers in the principles and techniques of fire safe designs and to explain how these are applied in practice.

Speakers from Tata Steel and BCSA made presentations on legislation, trends in fire protection and the impact of full scale fire tests.

Leading fire engineering practitioners Arup Fire, WSP, Buro Happold and Vulcan presented using relevant case studies to illustrate current best practice, including a detailed review of the structural fire engineering of The Shard in London. The Association for Specialist Fire Protection also outlined their work in maintaining standards and supporting specifiers.

The online presentations are free to view and available to all. Registered users of ***www.steelconstruction.info*** will also be able to download a CPD certificate for their training records.

Diary

For SCI events contact Jane Burrell, tel: 01344 636500 email: *education@steel-sci.com*
For Tata Steel/BCSA events register online at *www.steelconstruction.info/Steel_Essentials_2013*

Thursday 26 September
Portal Frame Design
Oxford

Tuesday 8 & Wednesday 9 October
Essential Steelwork Design (2 day course)
London

Tuesday 15 October
Overview of Steel Design to the Eurocodes
1 hour webinar

Tuesday 15 October
Steel Essentials Seminar
The Angel Hotel, Cardiff

Tuesday 22 October
Steel Essentials Seminar
Cavendish Conference Centre, London

Thursday 5, Thursday 12 & Thursday 10 November
Online Steel Building Design to EC3
1 day online course

Wednesday 6 November
Design Integration – Why Does it Matter?
Tower of London

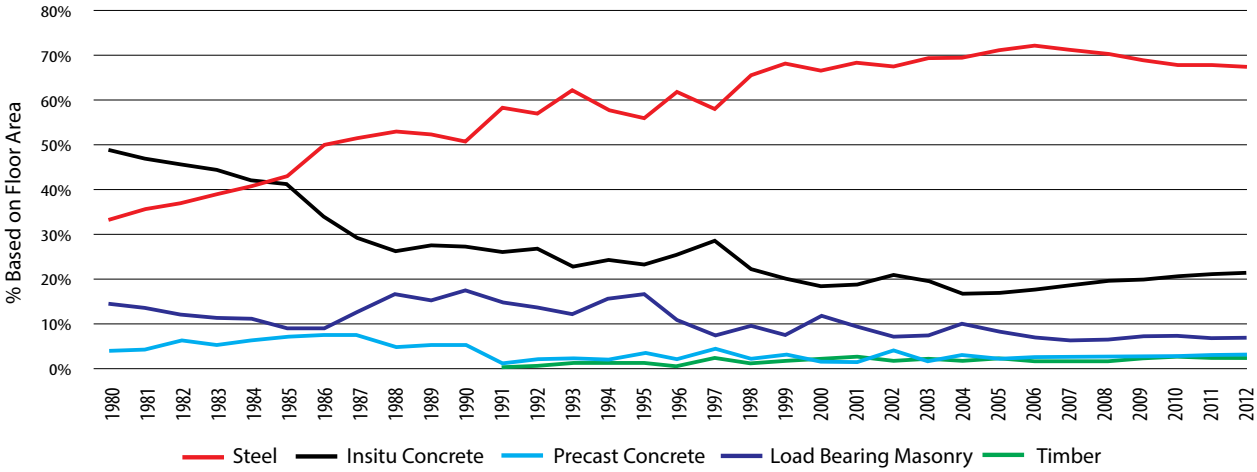
Thursday 21 November
Steel Essentials Seminar
Thorpe Park Hotel & Spa, Leeds

Tuesday 26 November
Loading to BS EN 1990
1 hour webinar

Thursday 28 November
Steel Essentials Seminar
The Caledonian Hotel, Edinburgh

Steel dominates market

The most comprehensive building frames market research carried out in the UK confirms the overwhelming dominance of steel construction in the key multi storey non residential sector.



The study from independent researchers Construction Markets shows steel retaining its leading position with a 67.1% market share in 2012, against a background of a severely declining market. Steel frames are even more popular in the multi storey offices sector where market share is over 70%.

The study, based on interviews with 450 specifiers, is the latest in a series going back to 1980, since when steel has steadily gained ground on alternative framing solutions such as insitu concrete which has fallen to a market share of only 21%. Precast concrete and timber account for 2.8% and 2.3% respectively, while load bearing masonry has 6.7%.

In the 'other' multi storey buildings category – which includes retail, education, leisure and health – steel has a share of over 66%.

The survey also shows that the market fell by over 18% in 2012, with the total floor area constructed in all multi storey buildings falling to 8,891,000 sq m, which represents only 68% of the market at its 2008 peak.

Steel's market share for all single storey buildings overall was unchanged in 2012 compared to 2011 at almost 85%. The shed market was down 47% in 2012 from its peak in 2007, and within that market the agriculture sector grew to 20% of the market.

Steel is also strong in the education, healthcare, leisure and retail sectors, enjoying a 69% market share in the latter in 2012.

Education continues to provide a significant workload for steelwork contractors as a significant number of new schools, colleges and student accommodation buildings rely on steel construction. Steel's market share in this sector was 56% in 2012.

In leisure, steel had a 64% market share in 2012 and in healthcare it had a market share of 56%.

Alan Todd, General Manager of Construction Services & Development at Tata Steel Europe, said: "We are pleased to see against the most challenging market background that any of us can have ever seen, when factors like cost effectiveness, speed of construction and sustainability are more important than ever, that steel is so confidently selected by the market as the preferred framing material."

The steel framed Heron Tower is the tallest building in the City of London

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ONE STEP AHEAD.

Commitment to innovation with steel

Nick Barrett meets Paul Westbury of Buro Happold, an engineer who has helped design some of the most prestigious steel structures of the last 15 years.

There are very few high profile living engineers but you just might have heard of Paul Westbury CBE. His list of achievements and contributions to the construction industry reads like the CV you could only ever dream of. For example at the tender age of 30, he was made the youngest ever partner and director of leading international engineering consultancy Buro Happold and that's just the beginning…

Five years ago, in 2008, he became Managing Director of the company's European business; he became Chief Executive Officer in 2011; he has been referred to as the Peter Rice – of Sydney Opera House fame – of his generation; and in January this year he was made a Commander of the Order of the British Empire (CBE).

Add to that his Gold Medal from the IStructE last year and the awards for the high profile major projects he has worked on including the London 2012 Olympic Stadium; the Emirates Stadium in London; Ascot racecourse; the Millennium Dome at Greenwich; Aviva Stadium, the new home of Irish football and rugby in Dublin; and the 2006 Winter Olympics Speed Skating Oval in Turin.

In addition to all of the above, Paul graduated with a first in engineering sciences from Cambridge University, has been named one of the UK's Top 100 Scientists by The Times and recently joined the judges of the newly launched Queen Elizabeth Prize for Engineering, which marks world changing engineering advances. His work on the Millennium Dome won him the 1999 Royal Academy of Engineering MacRobert Award for Innovation – the first construction project to win the award since the Severn Bridge superstructure some 30 years before – and in 2008 he was awarded the Royal Academy Silver Medal for his personal contribution to engineering.

And of course, Paul is a Fellow of the ICE, the IStructE, the Royal Academy of Engineering and the Royal Society for Arts, Manufacture and Commerce.

It's exhausting just writing all of the above, let alone actually achieving it in such a short working life. And he's even great to work with, as colleagues at Buro Happold and others who have worked with him speak only glowingly about his abilities and his modest personality.

Not that the sport loving, outgoing engineer is self-effacing – he doesn't have time for that, or any other, kind of front, running 27 Buro Happold offices across the world while heading up its burgeoning Sports and Entertainment business – but this fit, relaxed and youthful looking 41 year old does still have his feet firmly on the ground. He doesn't choose to talk much about his own achievements; "It's on our website," is about all the detail he likes to give, but his commitment to improving the engineer's lot in society comes across strongly.

Structural engineering is fortunate to have landed Paul as a champion – he started out with an interest in electronics first and his general engineering degree was sponsored by the defence giant Marconi. "I became more interested in structures as my degree went on, and slowly moved away from electronics. I am glad I was able to do that and I think we specialise way too early in our education system and having a breadth in education is important and I was lucky to have had the opportunity to explore."

Buro Happold has weathered the economic storms of recent years rather well, with 1,500 staff, 80% of whom are engineers.

Emirates stadium

About two thirds of their work is overseas, but that is not a major change. "My job is really about setting strategic direction and helping our engineers to be more efficient and effective. The role is to lead the business, not to run it, there is a subtle difference."

In 2002 Paul established and led the Buro Happold Design and Technology Board, set up to promote blue sky thinking and innovation. "Promoting innovation is a key role for me because without it a company like Buro Happold will die. We do this by getting the most out of our talented teams. There are no single big names any longer, we have to work together in multidisciplinary teams."

Although steel construction has been behind almost all of the major projects Paul has worked on, particularly the sports arenas, his earliest success was on tensile structures. Steel has featured in his portfolio ever since. "For all of the major projects I have been involved in steel has featured prominently. I like to use steel in my structures, it can be so expressive. Big span projects like stadia are engineering led and working with architects who understand their engineering is a joy, but at these 200m and 300m spans, it is all about steel at this scale.

"We pretty much know everything that we need to know about steel, about how it will behave in structures and there is an availability of manufacturing expertise in the steel industry going back centuries that we can rely on.

"UK steelwork contractors are excellent and their expertise is genuinely world leading. We like to get them in on projects as soon as possible, but not too early; we need to have space to do our own dance first otherwise there can be a danger that we won't explore new avenues. Embracing their fabrication skills and industry know how means that we can create better solutions every time."

Paul is making no predictions about what the next major success will be in what has already been a remarkable career. "I can't see myself doing anything other than the job I have though," he confesses. "I am well aware that I am standing on the shoulders of giants and I just hope to be able to continue to make the best contribution that I can. The past five years have been tough for the whole industry but I remain optimistic that we will be travelling on to even greater things."

Turin Speed Skating Oval

The O_2 London (Millennium Dome)

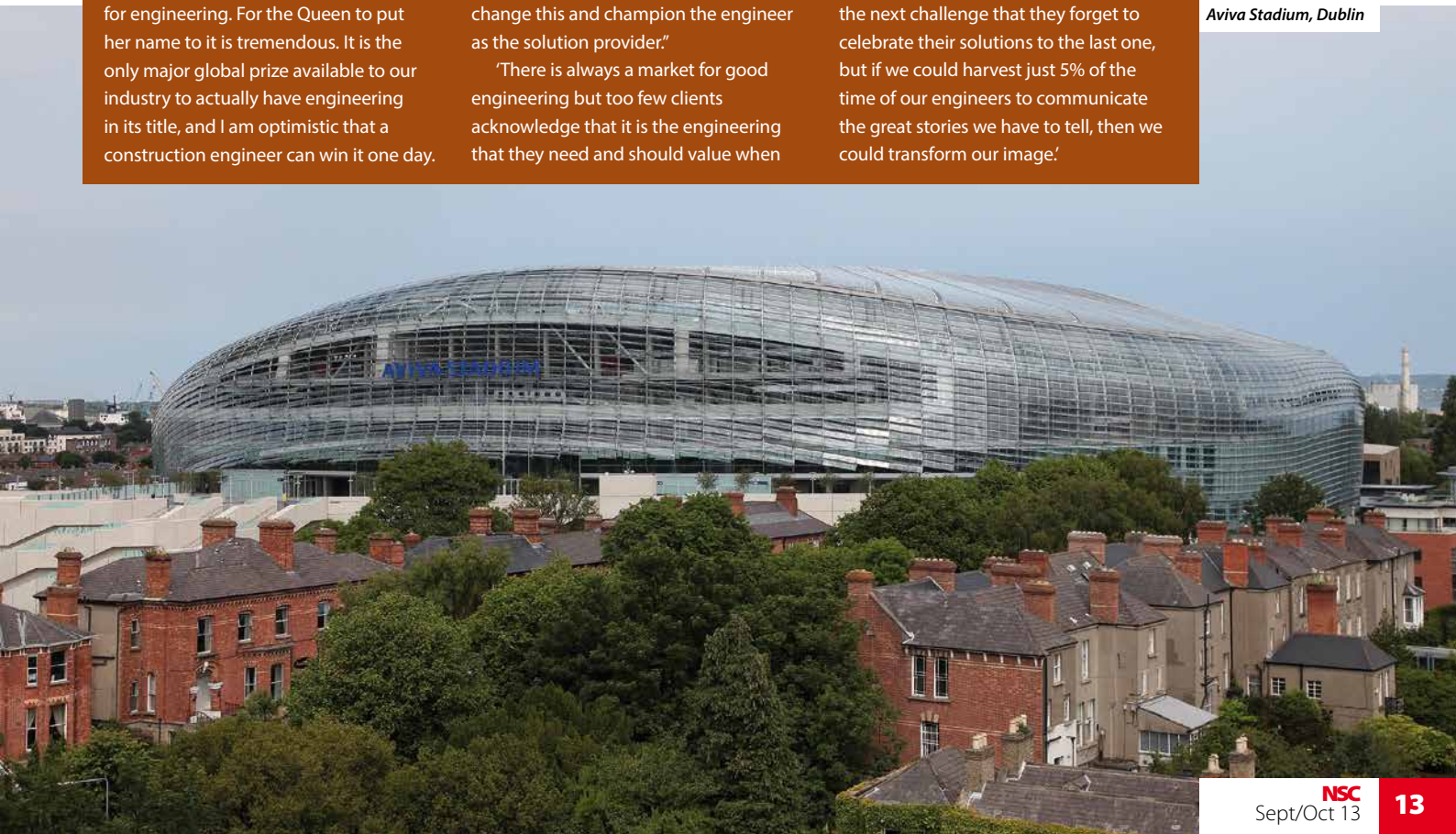
Boost for status of engineering

"Improving the status of engineering in society is something that I am passionate about and determined to do as much as I can to improve," Paul says, "so I was delighted as well as honoured to be invited to be involved in the Queen Elizabeth prize which is a big opportunity for engineering. For the Queen to put her name to it is tremendous. It is the only major global prize available to our industry to actually have engineering in its title, and I am optimistic that a construction engineer can win it one day.

"Engineering underpins everything we do in our society, it is the essential profession that makes our modern way of life possible, and there are success stories to be told every day, but somehow in the UK in particular this has become forgotten; we really need to change this and champion the engineer as the solution provider."

'There is always a market for good engineering but too few clients acknowledge that it is the engineering that they need and should value when they commission projects. We engineers need to do more ourselves to make people aware of our vital contribution to society, instead of letting those with the loudest voices and the arm wavers capture all the credit.

"We celebrate the complexity and fail to explain the simplicity of our design ideas. Engineers are so focussed on the next challenge that they forget to celebrate their solutions to the last one, but if we could harvest just 5% of the time of our engineers to communicate the great stories we have to tell, then we could transform our image.'



Aviva Stadium, Dublin

Steel delivers renewable solution

The second commercial straw burning power facility to be built in the UK has again relied on steel construction's coordination and speed of delivery.

Tubular steelwork supports an array of vessels

The search for new and more sustainable sources of energy is vitally important at present and many local authorities are investing in renewable energy plants where either household waste or a renewable commodity is used as fuel.

The latest project is a new 38MW renewable energy plant under construction near Sleaford, Lincolnshire. It will generate enough electricity to power 65,000 homes using straw and woodchip as a sustainable fuel source. It is claimed this will save 250,000t of carbon dioxide emissions per annum.

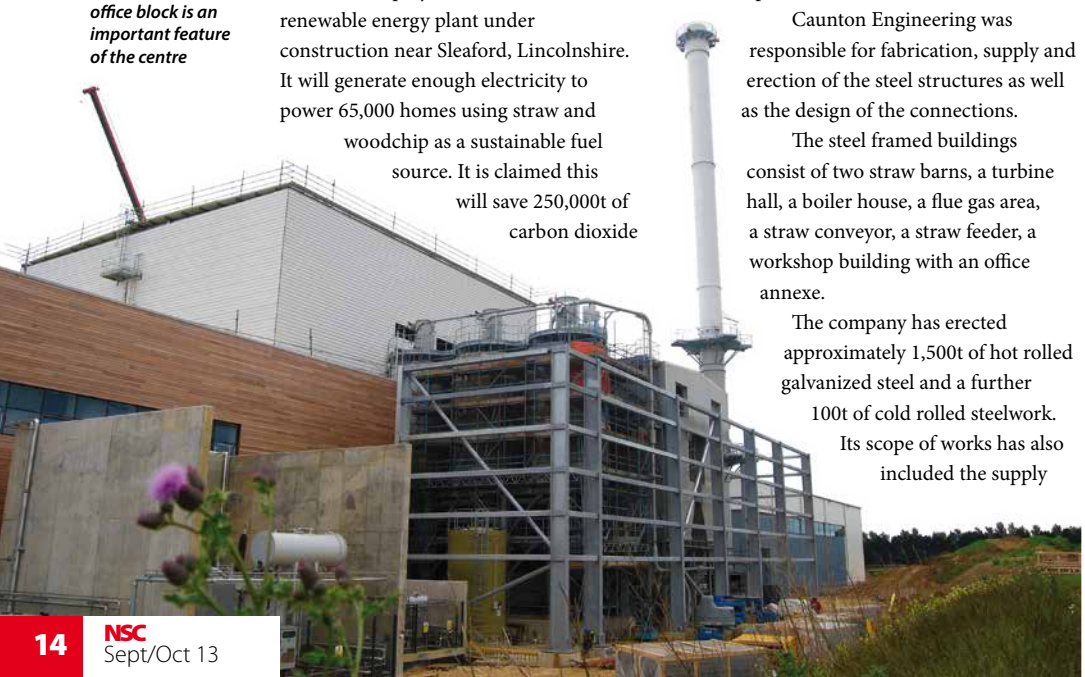
Owned by Eco2 Lincs, the plant is committed to supporting the local economy, as all of the straw will be sourced from farms within a 50-mile radius. Continuing its involvement with the agricultural sector, ash produced by the plant will be recycled into a crop fertiliser.

Caunton Engineering was responsible for fabrication, supply and erection of the steel structures as well as the design of the connections.

The steel framed buildings consist of two straw barns, a turbine hall, a boiler house, a flue gas area, a straw conveyor, a straw feeder, a workshop building with an office annexe.

The company has erected approximately 1,500t of hot rolled galvanized steel and a further 100t of cold rolled steelwork. Its scope of works has also included the supply and installation of more than 1km of hand railing along with numerous stair towers, staircases, ladders, platforms and metal flooring.

A timber clad steel framed office block is an important feature of the centre



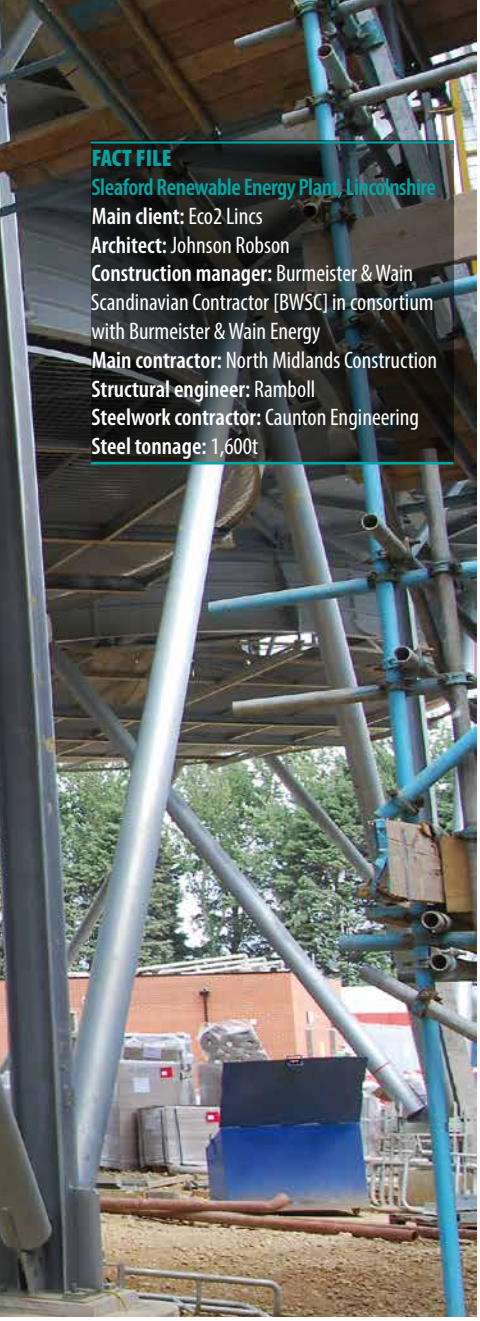
Work on the project began in early 2012. The erection of the ten main steel framed buildings commenced in July of last year.

Due to the high number of different trades working on the site, logistics and coordination have played a key role on this project. As well as the usual construction workers, there are a significant number of teams installing and comissioning the generation equipment to get the plant operational as soon as possible.

"Our steel erection programme lasted nearly 12 months," explains Gary Hatton, Caunton Engineering Project Manager. "We had to coordinate all of our work around other trades, making several revisits and sometimes erecting our steelwork around installed energy generation equipment."

Coordination of the steelwork with other activities has been a key driver for the project.

"Much of the project's steelwork was designed to include temporary works, so



FACT FILE
Sleaford Renewable Energy Plant, Lincolnshire
Main client: Eco2 Lincs
Architect: Johnson Robson
Construction manager: Burmeister & Wain Scandinavian Contractor [BWSC] in consortium with Burmeister & Wain Energy
Main contractor: North Midlands Construction
Structural engineer: Ramboll
Steelwork contractor: Caunton Engineering
Steel tonnage: 1,600t

The energy centre takes shape in the Lincolnshire countryside

The boiler house was erected around the process equipment

that it could be erected around equipment installation," explains John Whitfield, Ramboll Project Associate. "In some areas the steel frames were designed so that some parts could be left out to allow access for large pieces of equipment."

The first steel buildings to be erected were the site's two 0.75 acre straw barns. These two identical portal framed sheds are structurally independent but share the conveyor system that will feed straw to the boiler house.

The sheds will receive deliveries of straw bales, and are double span portals with 20m spans and a single line of internal columns - ideal for storage and vehicle movements.

"When we erected these two structures it was quite early in the overall construction programme and we had the area to ourselves," says Mr Hatton. "Once they were finished we left site until most of the turbine and boiler equipment had been installed."

The completed straw barns were then used as assembly areas for the plant's boiler. Some parts of this structural frame had already been constructed, but one elevation and the roof were completed while the boiler was being commissioned.

"We had to coordinate all of our work around other trades, making several revisits and sometimes erecting our steelwork around installed energy generation equipment."

Once this was complete it was transported across the site to its permanent position and the boiler house steelwork erected around it.

The boiler house is a large 29m high braced structure, designed with a series of temporary wind girders positioned around the perimeter. These were only removed once the main boiler equipment was in place.

The adjacent turbine hall was designed in a similar way, with temporary bracing and props, allowing openings to be left in the steel frame.

"Using steel allowed us to design frames that could be erected quickly and in conjunction with other trades," says Mr Whitfield. "For efficiency, and to achieve the long spans in the boiler and turbine buildings, we also used cellular rafters."

During subsequent visits, Caunton erected the other structures, including the conveyor system, which is an enclosed bridge formed with box sections and supported on 8m high steel columns. As well as connecting the two straw barns with the boiler house, it carries the conveyor system over passageways and a road.

One of the last buildings to be erected was the workshop and office annex. Constructed around a regular grid pattern, the building is a traditional beam and column design with a composite floor. "This was one of the quickest structures to be erected, because like the straw barns, we had the site to ourselves," says Mr Hatton.

Summing up, Stuart Campbell, North Midland Construction Business Development Director, says: "We're delighted to be involved in such an innovative project that will have a positive impact not just on the environment but also on the local economy through the creation of jobs in the plant and through the supply chain."

Steel formulates iconic research facility

A cancer research centre in Manchester is being constructed with a steel frame to create a building that can flexibly accommodate both research laboratories and office space.

A series of north lights will allow natural light into the lightwell

Raking columns create the desired visually exciting structural form

FACT FILE
Manchester Cancer Research Centre
Main client: The University of Manchester
Architect: Wilson Mason and Partners
Principal contractor: M+W Group
Main contractor: Pochin
Structural engineer: Aecom
Steelwork contractor: EvadX
Steel tonnage: 575t
Project value: £28.5m

The Manchester Cancer Research Centre (MCRC) building is funded by The University of Manchester, Cancer Research UK and The Christie NHS Foundation Trust. It is being built on land owned by The Christie – a specialist cancer hospital in South Manchester.

The new building will aid the expansion of research by providing space for an additional 150 cancer researchers whose research will focus on understanding how cancer starts, develops and progresses, as well as 100 clinical trials support staff. It has been designed to facilitate collaboration between researchers and clinicians to translate discoveries made in the laboratory into new personalised treatments for cancer patients.

The facility is expected to attract leading experts from across the globe and so the client's brief to the design team stipulated an iconic flagship development.

Situated overlooking a busy thoroughfare, the structure is destined to become a local landmark with its visually exciting cantilevers and sloping facades. This complex structural design had to incorporate both research laboratories and offices and this led to the decision to employ a hybrid approach to the structural frame.

"Using a steel frame allowed us to create the desired structural shape and the hybrid design helped solve any vibration issues connected with the sensitive equipment which will be installed within the completed facility's laboratories," explains James Potter, Wilson Mason Project Architect.

The building is divided in half by the entrance and a large lightwell. Three interlinked laboratory wings are positioned on one side of this open space with the offices on the other side. Both consist of three levels (including ground floor), with the laboratory area's topmost level occupied by a plant floor.

The three levels of office accommodation have been constructed using a composite solution with steelwork supporting steel floor decking.

In the laboratory areas a steel frame supporting precast planks is utilised to accommodate the varying degrees of vibration due to the research equipment.

The planks vary in depth, up to a maximum 350mm thickness, depending on the equipment to be installed and the soffits will be left exposed to optimise thermal mass, thereby helping to cool the building, explains Jon Sheppard, Aecom Project Engineer. "Although this was of secondary importance to the vibration issue."

Aside from the two disparate functions accommodated within the structure, the overall form of the building has presented some interesting design challenges.

"The complexity of the shape lends itself to steelwork with reinforced cores," says Dave Mills, Pochin Project Manager. "We have split levels, cantilevers and sloping facades, all of which would have been difficult to achieve with any other material."

Each of the laboratory wings feature a 12 degree sloping façade, making them look like protruding blades. They are each supported by sloping shear walls and cores, and formed with raking columns.

Overall the stability for the building's frame is derived from the cores with additional stability provided by bracing. Temporary steelwork was also extensively used throughout the sloping areas, as these parts of the frame were not fully stable until they were topped out and the floors installed.

According to Mr Potter, the sloping facades not only furnish the structure with some standout architectural elements, they also help maximise the available footprint.

"By leaning away from the lightwell the first floor has a larger footprint and so provides more valuable laboratory space," he adds.

The majority of the raking columns will be left exposed, adding further to the modern and aesthetic feel of the laboratory zones and the adjacent lightwell.

Spanning the lightwell, a steel footbridge will connect the offices with the laboratories at first floor level. Above this, the building's central void is topped with a series of north lights, formed with steel frames.

These frames were brought to site as welded triangles and once they were bolted into place, secondary bracing was then added.

The north lights will illuminate the centre of the building, as well as some of the laboratories with natural daylight. The entrance area's public café will also benefit from this feature.

Professor Nic Jones, Director of the Manchester Cancer Research Centre, says: "The new Manchester Cancer Research Centre building has been designed to provide state-of-the-art research facilities that will enable our scientists to make ground-breaking discoveries that lead to improved treatments for cancer patients. The new centre marks an important new phase in cancer research in Manchester and will be completed and ready for use in Summer 2014."

Steel erection

The MCRC site is compact with limited space for materials to be stored or cranes to be located. Steelwork contractor EvadX has employed a just-in-time method for its steel deliveries with everything lifted into place the day it arrives to site.

Another challenge is the fact that the structure has eight cores, which provide lateral stability to the frame.

"Avoiding the cores while lifting steelwork, planks and steel floor decking was a considerable challenge and required a lot of logistical planning," says Andrew Roberts, EvadX Project Manager.

Because of the job's complexity the 575t steel total includes hundreds of small sections. At the other end of the scale, the longest pieces of steel to be erected are a series of 18m long x 700mm deep fabricated beams which form the entrance and lightwell.

Another large steel element is a 16m long × 5m high truss which forms the office area's feature 11.5m cantilever on the front elevation. The truss is situated on the second floor and as well as creating the cantilever the first floor of this part of the building is hung from it.

The truss was brought to site as a completed and fully welded section, and lifted into place during one four-hour procedure.

"We used two 50t capacity mobile cranes in a tandem lift. As it was so big we had to employ traffic control measures to bring the truss close to the site and then lift it into place," explains Mr Roberts.

Council restores local landmark

FACT FILE
London Borough of Bexley civic offices
Main client: London Borough of Bexley
Architect: Bennetts Associates
Main contractor: Mace
Structural engineer: Buro Happold
Steelwork contractor: Graham Wood Structural
Steel tonnage: 244t

The London Borough of Bexley is extending and refurbishing a former building society headquarters into civic offices.

The former headquarters of the Woolwich Building Society in Bexleyheath, originally built in 1989 and vacant for the past eight years, is currently being converted into civic offices for the London Borough of Bexley.

Situated on a prominent town centre site, the Woolwich building is a well known local landmark. By refurbishing and extending the building, the council says it not only preserves the structure, it will also enable it to bring together office based staff from four ageing sites saving more than £1M a year in the process.

The work will also act as a catalyst for further developments and regeneration. Once the council vacates its present town centre site, a large mixed use scheme is due to get under way.

Steel is playing a significant role in the project, as a new two-storey extension to the rear of the building and the reconfiguration of parts of the existing structure are relying on steel construction.

Speed of construction is one of steelwork's many attributes and the extension, which accounts for 200t of the overall steel total, took only two weeks to erect.

Built around a regular grid pattern, which includes some 16m long spans, the extension is structurally independent, gaining its stability from strategically positioned cross bracing. However, it is linked to the old building by three first floor steel footbridges and between the extension and the existing structure, a covered internal space (atrium), containing a café, will be created.

The ground floor of the extension will house the new council chamber and its public gallery, as well as a series of meeting rooms. Above this, on the first floor there will be offices for the council leader and members.

The council chamber is accommodated within the middle portion of the ground floor and occupies a large open plan column free space. The construction of this important feature was one of the drivers for choosing a steel frame for the extension.

"We looked at a number of options and a steel composite solution using precast planks was the most economical," explains Bennetts Associates Project Architect Franziska Michel.

"Steel offered us the slimmest form of construction and helped us maximise the floor to ceiling heights."

Only a 50mm topping has been added to the planks, while the supporting beams are all cellular sections. These beams accommodate service integration, which in turn further

The extension will be linked to the existing building by a covered atrium

Exposed steelwork is a feature of the council chamber

Cellular Beams are used for service integration

helps the project's aim for a slim and economical design.

To further increase the available headroom in the column free council chamber, it will feature a sunken floor, increasing the floor to ceiling height by 0.8m.

The covered courtyard or atrium separating the new extension from the refurbished building will have a glazed roof, allowing plenty of natural light to penetrate the space.

Steelwork contractor Graham Wood Structural erected a series of 9.6m long box sections to span the atrium and support the glazing.

"We had to construct a series of steel H-frames within former window recesses of the existing building to accept the steelwork for the atrium roof," explains Gregor Hunter, Graham Wood Operations Director. "The frames have a stub onto which the box sections are bolted, while stubs on the new steel frame pick up the beams on the other side."

For most of the steel erection Graham Wood used a single 50t capacity mobile crane, while the installation of the precast planks (also in its remit) required a much larger 220t machine.

"Steel offered us the slimmest form of construction and helped us to maximise the floor to ceiling heights."

Prior to erecting the extension Graham Wood installed steelwork for a new floor within the existing structure. A former deeds store, located towards the rear of the building was converted into back-of-house space and offices.

Formerly this large storage area occupied a large double height space, but with the installation of new steelwork the project team filled in the void and increased the available office space on the first floor.

Steel channels were bolted to the existing columns to strengthen the structure. They support a new steelwork grillage that has been topped with steel floor decking to create a new and additional part of the first floor slab.

"This helped to create more office space within the reconfigured building and aided the design to make the environment modern and open plan," explains Ian Scott, London Borough of Bexley Project Manager for Major Projects.

Getting the new steelwork inside the existing building and erecting it was the more challenging part of the steelwork erection programme. Using a mobile crane was out of the question, as it could not reach into the building, so a ramp was built allowing the steelwork to be transported into the building and erected by a mini crane that entered the structure via the same path.

Summing up, Andrew Sweeney, Mace Project Manager says: "We are very proud to be delivering a project that will lead to the regeneration of a locally important and respected building."

Completion of the work is scheduled for spring 2014 and the council is set to move into its new civic offices next summer.

Views through the Memorial Arch were an important design consideration for the new building

Bridge to academia

A new arts and innovation centre at Bangor University will provide first class facilities for students as well as becoming a hub for the local community. Martin Cooper reports

FACT FILE
Bangor University Pontio Project
Main client: Bangor University
Architect: Grimshaw
Main contractor: Miller Construction
Structural engineer: Atkins
Steelwork contractor: Elland Steel Structures
Steel tonnage: 1,100t

Building bridges between the arts and science, the University and the local community, and the city to the wider world are not aims usually associated with a construction project.

But this is precisely what the Pontio (Welsh for 'to bridge') Project will hopefully achieve in Bangor once it opens next year.

With its 500-seat theatre, cinema, spacious lecture theatres, design and innovation centre, students union as well as a bar and café, the project will create a link between the nearby city centre and the existing University buildings.

The project is being built into the steep slope of the hill that the listed university main arts building sits upon and stretches from near the summit to end at the foot of the hill close the Memorial Arch, another local landmark.

Bringing the gown to the town is how some have described the job, as many of the facilities will be open to the general public as well as students.

A cultural beacon for the people of Wales and their language, Pontio will become a hub for the local community, says the University. Its light airy spaces, relaxing cafés and outdoor amphitheatre will provide people of all ages with places to meet, greet or be entertained.

Constructing these new facilities has been a prime objective for some time, and much of the sloping site's groundworks and a large retaining wall were completed before Miller Construction started on site last year.

These preliminary works included the demolition of a theatre, which will be replaced by the project. The University and the City have been without such a facility for sometime now and so speed of construction is vital, not just for theatre goers, but for the project in general.

"Steel has been used for much of the project for its speed of construction as well as the many long spans we have."

"Steel has been used for much of the project for its speed of construction as well as the many long spans we have," explains Jon Paull, Atkins senior Structural Engineer.

"Once the structure reaches a series of flat plateaus up the slope, steelwork then springs off the concrete retaining wall and substructures," adds Mr Paull.

The theatre space is formed by a large concrete box that is surrounded by an independent steel frame forming the circulation areas, back of house space and dressing rooms.

"For acoustics both frames are totally isolated and independent of each other," says Shaun Thomas, Miller Construction Senior Project Manager.

Acoustic isolation has also been necessary above the theatre space as this part of the project is topped by a large open plan lecture theatre.

In order to guarantee no sound will transfer between the two spaces, a series 20m long trusses span above the theatre's box and support the lecture space above. A 1m void between the trusses and the theatre's roof guarantees acoustic isolation.

Elland Steel had to use a 250t capacity mobile crane to install these large trusses as they were too heavy for the tower crane.

The lecture theatre is stabilised by a series of cross bracings, which in turn are supported, by a series of Vierendeel trusses

The steel frame is divided into separate structures by movement joints

What's in Pontio?

The main theatre will boast a flexible auditorium with the ability to transform the venue. From a 450-seat traditional proscenium-arch theatre experience, to theatre-in-the-round, to standing only gigs for 700 plus, this will be the first space of its kind in north west Wales.

The lecture theatre above the theatre will seat 120 for more intimate events as well as being an ideal venue for community-based activities and student societies, while the 200-seat cinema will be supported by state-of-the-art facilities.

The innovation and design studios will boost the University's cross-disciplinary teaching programmes and encourage collaborative work between students, staff and local businesses.

Pontio will also be home to the Student Union's offices and student radio Storm FM, putting them back at the heart of the campus.

Throughout the Centre, new teaching and social learning spaces will be created to support a modern educational environment, along with digital showcase facilities to enable the display of work using the latest in digital technology.

that span the full height of the facade.

Because of the various functions of the project the building is in fact split into four different structures, all interlinked but separated by movement joints.

The functions also mean different stability systems have had to be employed. Cross bracing has been inserted around most of the structures, but in areas with large glazed façades, either shear cores or portalised bays have been utilised.

A more hybrid approach has been utilised for the cinema area that is partially enclosed by the project's retaining wall. Here the upper level containing the cinema is steel framed.

"A large open column free space was needed for the cinema and this has been created by a series of 17m long steel trusses," says Mr Thomas.

Work is currently progressing on schedule and Elland Steel Structures completed the steel erection in September. Construction is due for completion next May and after a fit out programme the facilities will be open during the autumn.

The atrium links the new entrance to the existing main Arts building

Preserving the view

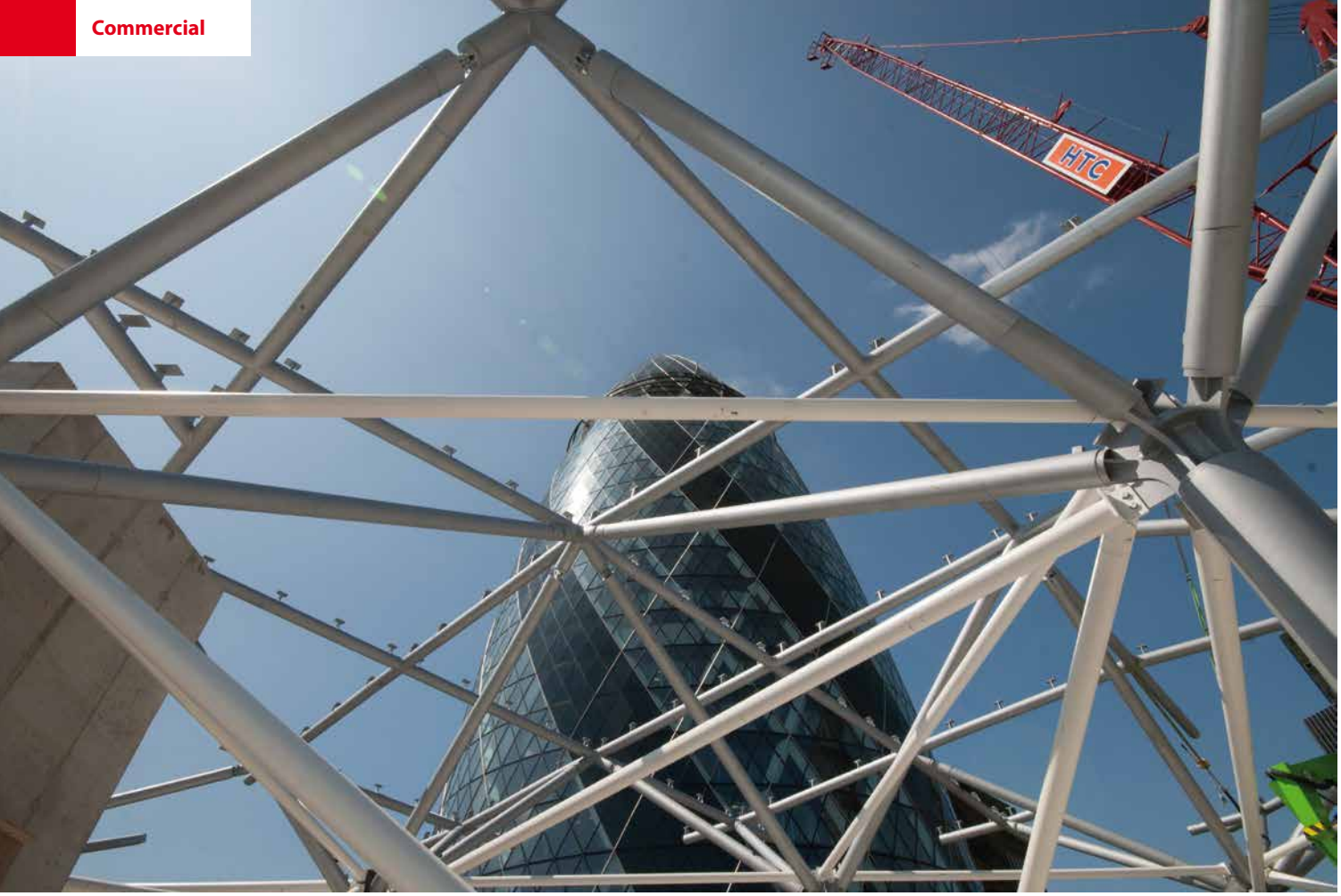
As well as linking Deinol Road in Bangor city centre with the existing university buildings at the top of the hill, the Pontio Project will also aim to preserve views of the historic main arts building from the memorial arch.

This will be achieved by a long fully glazed atrium or street that will divide the building in half and allow people to see the top of the hill from the main entrance.

Providing the main circulation within the building, the atrium will also deliver a covered route up the hill to the other university buildings.

Secondary steelwork will form the atrium, connecting to the main steel frame via a series of sliding connections and intricate detailing.

"The high level glazed atrium spans between three independent structures and so in effect, the glazing system also acts as a movement joint," explains Mr Paull.



Foundation reuse creates sustainable landmark

FACT FILE
6 Bevis Marks, London
Main client: Bevis Marks Development
Development manager: City Office Real Estate
Architect: Fletcher Priest Architects
Main contractor: Skanska
Structural engineer: Waterman Structures
Steelwork contractor for main frame: William Hare
Steelwork contractor for sky garden: Tubecon
Steel tonnage: 2,200t

An extensive sustainability agenda, incorporating the reuse of existing piles, resulted in a 16-storey London commercial development replacing an old eight-storey structure. Martin Cooper reports.

The building occupies a prestigious City of London site

Maximising the available office space within a city centre commercial development is always one of the prime objectives for any project.

The reuse of existing piles on a project at 6 Bevis Marks in the City of London has not only allowed a 16-storey structure to replace an old eight-storey building, doubling the lettable space, but cost, programme and $C0_2$ savings have also been achieved.

"A steel framed structure with precast slabs was demolished and replaced with a 16-storey steel structure incorporating composite deck," says Julian Traxler, Waterman Structures Director. "This lighter form of construction allowed us to reuse the existing foundations and achieve the net lettable areas the client wanted."

A total of 67 piles were reused, while the existing retaining walls were also incorporated into the new building, all of which contributed to a carbon saving of approximately 1,000t.

Reusing 52% of the original structure contributed significantly to the shortening of the construction programme and the aim of achieving a BREEAM 'Excellent' rating.

A total of 37 new larger diameter piles and 66 mini piles were installed to accommodate the different loading patterns of the new structure, while the two lift cores for the new larger building had to go in similar locations as those of the former structure.

With floor plates up to 53m long, the span between columns has been dictated by the position of the cores and the client's requirement for flexible column free spaces. The beams generally span up to 13.5m and the clear open plan spaces are exemplified by the fact that there are only three internal CHS columns on each floor.

"The flanges are recessed to ensure that there is no projection beyond the primary profile," explains Chris Field, Skanska Senior Engineer.

"This limits spatial constraints and helps create the desired open plan offices by giving clear lines without intrusive columns."

Garden in the sky

The 6 Bevis Marks development is topped by an ETFE covered roof garden, which will be a dramatic addition to the local skyline.

Formed by a framework of CHS steel members the garden is open to the elements on two sides. The tubular steelwork wraps around two elevations of the structure, forming a curved profile and attaches to the main frame at level 11 on one side and level 15 on the other.

A total of eight 355mm diameter CHS column 'trees' support the steel frame at roof level. To form the framework up to seven rafters – typically 193mm diameter CHS members – are connected to each column.

"Each column tree is bespoke and the roof framework was trial erected at Tubecon's fabrication yard, prior to being delivered to site, to make sure each piece fitted correctly," explains Mr Field.

Minimising the weight of the structure was a key objective throughout the project. For efficiency the main beams are typically 600mm deep fabricated cellular sections, with varying sized circular and rectangular holes for service distribution.

The perimeter columns vary from 300mm × 300mm CHS sections to 550mm x 350mm RHS sections.

Confined City site

The new L-shaped building is located adjacent to the 41-storey Gherkin at 30 St Mary Axe and on a street with predominantly eight-storey structures.

In order to fit comfortably into its surroundings, 6 Bevis Marks steps down from 16-storeys to 11-storeys towards the lower height buildings. Stepped roof terraces at levels 13 and 15 add some extra architectural interest, while both of these features are overlooked by the much larger rooftop sky garden (see box).

Constructing a new commercial development within the City of London always presents a number of challenges. When Skanska started on site in January 2012, the Olympic Games were on the horizon and this meant road closures in London, resulting in the delivery of large items such as cranes being restricted.

"We had to keep a 3m wide lane open on Bevis Marks at all times," says Andy Hankin, Skanska Project Director. "This meant our operations were severely restricted and so we had to come up with a method for utilising large cranes without closing the road."

Skanska designed two 7.5m high steel trestles that were erected straddling the site and the road. A large 500t capacity mobile crane was then able to position two of its outriggers on top of the trestles, with the other two located within the permissible zone of the partially closed road.

"The trestles, which were easily dismantled and re-erected, allowed us to use a crane to help install piling equipment, a tower crane and the large steel transfer beams," explains Mr Field.

The mobile crane's position was fixed, and its reach was limited by the nearby cores. This presented a problem when it came to lifting three large transfer beams.

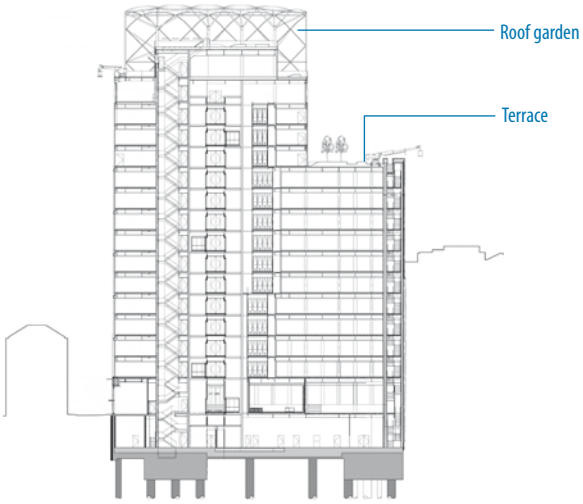
These beams, which span a ground floor loading bay and the structure's reception represent the largest steel elements of the entire project and required a lot of planning to install.

The largest beam, installed above the loading bay, measures 15m long by 1,500mm deep with 1,000mm × 100mm flanges and twin 50mm webs. Weighing 38t the centre of gravity of this beam had to be shifted while it was lifted in order to avoid the core.

Ten tonnes of kentiledge was bolted to the end of the beam, moving the centre of gravity by 450mm and allowing the beam to be successfully installed.

Two slightly smaller transfer beams for the roof of the entrance area, each 9m long and weighing 25t each, were lifted into place in a similar way.

All the transfer beams were successfully erected during one day, meaning partial road closure was kept to minimum.



Long clear internal spans are provided by the steel frame

A 38t transfer beam with kentiledge is lifted by a 500t capacity mobile crane

Site welding procedures to deal with potential hydrogen cracking

Dr Richard Henderson (SCI)

A transfer beam on one of the upper floors of 6 Bevis Marks was erected in two halves which were site-welded together. This welded joint is clearly of major significance because a large proportion of the tensile capacity of the beam bottom flange must be developed. This is arguably the most important part of the joint as the top flange is in compression and the shear force near mid-span is likely to be small.

The actual process of welding on site is very little different from the equivalent workshop process but there are other factors which must be taken into account, the principal of which is that there are few fixed facilities or shelter available. Site welding also necessarily involves holding the parts in their correct positions and the welding is carried out in whatever orientation and location is determined by the joint.

Precipitation, wind and low temperatures can all have a substantial adverse effect on the quality of welds. Dew, condensation and atmospheric humidity are all sources of moisture which increase the amount of hydrogen in the weld pool and increase the risk of hydrogen cracking. A suitable weld procedure is required which controls the hydrogen input and allows greater opportunity for the hydrogen to diffuse out of the weld, just as for a shop weld, taking into account the carbon equivalent value of the steel.

The "combined thickness" of the joint is the sum of the element thicknesses 75 mm from the weld and the larger this value, the greater the heat sink and the higher the rate of cooling. A higher heat input is required to allow more time for hydrogen to diffuse out of the weld. The heat input is proportional to the product of the weld current and voltage, and inversely proportional to the welding speed. The weld preparation should also be chosen for simplicity: welding "downhand" (where the weld pool is lower than the electrode) is the easiest position. All these issues are specified in the weld procedure.

Welding consumables such as manual metal arc electrodes must be stored in dry conditions and only taken out when they are required. Some electrodes require baking and must be stored in heated quivers to lower the amount of hydrogen in the weld. Windy conditions can disturb or destroy the gas shielding around the arc which can affect both the mechanical properties and the appearance of the weld.

SCI publication P161; Guide to site welding gives detailed information on all these issues.

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Steel is good for Guinness

The famous Guinness Brewery in Dublin is investing in new high-tech facilities housed inside a large steel framed structure. Glasses were raised to steel's speed and flexibility.

The steel mezzanine level has holes through which brewing vessels will protrude

FACT FILE
Guinness, Dublin, New Brewhouse
Main client: Diageo
Architect: RKD Architects
Main contractor: John Sisk & Son (Holdings)
Structural engineer: Arup
Steelwork contractor: Kiernan Structural Steel
Steel tonnage: 1,500t

Inquisitive beer drinkers will be interested to know that every pint of Guinness sold throughout Europe and the USA currently originates in Dublin. For more than 250 years the famous stout beer has been brewed in the city and is an Irish icon.

To guarantee its long term future, consolidate some of the company's other products and rejuvenate the historic St. James's Gate Brewery, the facility is in the midst of a multi-million Euro investment programme which will result in the construction of a new brewhouse and grain intake building.

Enlarging one of the world's most famous breweries brings with it a host of unique challenges, not least that existing brewing operations had to carry on 24 hours a day, seven days a week in parallel with the construction works.

Main contractor John Sisk & Son (Holdings) has had to employ a full time logistics manager to ensure a smooth and seamless coexistence, as the construction site is adjacent to many operational buildings.

The full scope of works includes a large portal framed brewhouse with an attached two-storey structure providing office and production support. The brewhouse is linked to a new six-storey braced grain intake and materials handling facility which is also of steelwork construction. The project also includes significant steel piperacks and associated equipment bridges linking the new brewhouse to the existing brewery.

Getting the new facilities up and running as well as fully integrated into the overall brewing operation is vitally important to the client.

Speed of construction was consequently one of the main drivers for choosing a steel solution for the project's buildings.

"Steel offered the quickest solution," says Thomas Lynch, Sisk Site Engineer, commenting on the choice of framing material.

The brewhouse part of the job consists of a large portal frame approximately 100m long, 13m high with a 36m internal span and perimeter columns spaced a 6m centres. Inside there is a large mezzanine level that

The construction site was formerly a storage yard for the brewery

allows access to beer production vessels, the largest of which is 14m in diameter. The vessels are generally supported on piled foundations at ground floor slab level with their tops protruding through the mezzanine floor.

"The successful installation of these large brewing vessels relied on steel construction's flexibility," says Hugh O'Dwyer, Arup Project Engineer.

"The steel frame for the brewhouse was erected in two phases. Initially the columns, vertical bracing and mezzanine floor steel were erected so allow installation of the large diameter vessels. This was followed by erection of the roof steel including rafters and roof bracing. This two phase erection process, with vessel installation in between, would have been a more difficult procedure with any other material."

Steelwork contractor Kiernan Structural Steel brought the roof rafters to site in 18m lengths and then bolted them together on the ground into complete 36m long sections. They were lifted into place using one 350t capacity mobile crane, positioned outside of the building's footprint due to the confined location.

The roof of the portal framed brewhouse supports an array of ductwork, pipework and a material conveyor system. Most of this assortment of metalwork was included only when the design was at quite an advanced stage and necessitated redesign of the portal frame members just prior to material order to ensure that adequate loading allowances were included.

"Because of steel's flexibility we were able to quickly redesign the brewhouse frame. Section sizes to the frame were increased in size in order to take the extra loads," adds Mr O'Dwyer.

During the initial steel programme Kiernan Structural Steel had much of the site to itself, with the exception of the 500t capacity crane used for the vessel installation.

However once the brewhouse was erected and the steel team moved onto constructing the grain intake building the site was far more confined.

"This was when our logistics planning came to the fore as we had to keep moving the crane's position during the erection programme in order that they didn't obstruct the brewery's internal traffic," explains Mr Lynch.

The grain intake building is a 25m high six-storey structure predominantly constructed with traditional beam, column and fabricated 400mm x 200mm box sections. Built around a regular grid, the structure is linked to the brewhouse and is provided with horizontal and vertical bracing to achieve overall stability.

Artists impression of the finished project

Erecting steel in a confined site surrounded by an operating brewery has been a challenge

Lifting Bridges

The new facilities are being built on land formerly used as a keg storage yard. This is close to many operational parts of the brewery including some very busy internal access roads. Some of the larger lifting procedures, such as the installation of steel bridges, have required these roads to be temporarily closed or rerouted.

Kiernan Structural Steel has erected a number of pipe racks and bridges as part of its steel package. The bridges connect the brewhouse and grain intake building with the existing brewery and provide links to convey utilities and finished product.

The largest of these structures was 18m long and needed a 350t capacity crane to lift it. Fabricated from plate girders, the bridge was brought to site with all of the services installed which meant fewer follow on trades were required after the bridge was installed.

"We had to coordinate with the brewery and the in house Diageo M&E contractors during this lifting operation as we temporarily blocked a very busy loading bay," explains John Kiernan of Kiernan Structural Steel. "While some of our other lifts stopped tanker movements, all which required pre-planning and coordination so the brewery's operations weren't disrupted."

Advising the industry

Designers and specifiers are reminded that there is an easy way to solve any steel construction query – contact the Tata Steel Construction Hotline.

Whatever you need to know about steel construction, whether it's a query about section sizes, fire engineering, intumescent paint or even bolts, there is a one-stop shop available that can assist with any design, specification, use or performance related issue.

At the Tata Steel Construction Hotline a resident team is on hand to get enquiries to the right technical experts either within Tata Steel or the wider steel sector.

01724 405060

The Construction Hotline offers impartial advice and support that ensures the best value solution is given.They have a wide range of experience dealing with all sorts of diverse calls and if they don't know the answer themselves, they will know someone who does.

The hotline is a free service and is more than ten years old. During this time it has provided thousands of people with invaluable construction industry assistance and has become an invaluable resource that supports the steel construction supply chain.

By simply dialling 01724 405060 during office hours, you are immediately in contact with a team who can answer questions on a myriad of topics, including specifications, steel availability or even codes and standards. If they think the enquiry can be better answered more thoroughly elsewhere the call will be diverted.

"In addition to our own knowledge and experience we have access to experts across other centres of excellence within Tata Steel and to those within at the British Constructional Steelwork Association (BCSA) and the Steel Construction Institute," adds Richard Laffan of the Construction Hotline.

"One key aspect of the Construction Hotline is to support our customers in getting the right information and guidance. It's a great place to start and get access to the wealth of details and advice on steel."

Distributing information and enquiries within and about Tata Steel's many businesses is another important part of the hotline's mission.

Someone that works for Tata Steel Energy & Power in Corby may have a question relating to construction products produced at Shotton. The Hotline again provides the best link for these enquires.

Another key aspect of the hotline's appeal is its human touch, something sadly lacking from website enquiry services.

"The one to one service is key," says Neil Tilley, Tata Steel Manager, Construction Market Development. "Looking at a website to get information is fine, but being able to pick up the phone and actually speak to another person is preferable."

Often an initial question leads on to another. As a telephone service, the hotline team are able to deal with all follow-on aspects to an enquiry during a single conversation, ensuring that the caller gets all of the information they need there and then.

"The human touch is important and definitely one of the main benefits of the hotline," agrees Carol Micklethwaite, Technical Advisory Engineer. "Enquiry lines for many large companies have a recorded option message which puts many people off. By phoning the hotline you are directly through to one of our team who can start answering the enquiry immediately."

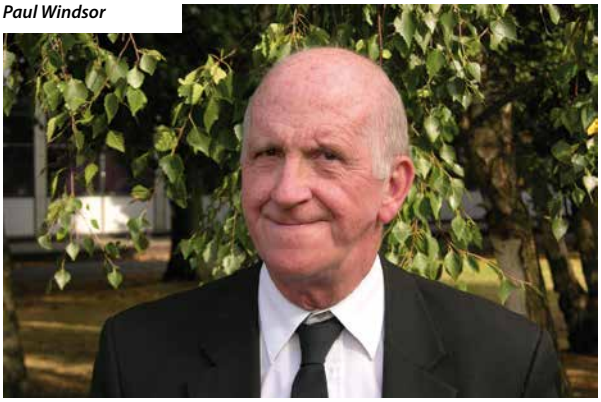
Contact the Tata Steel Construction Hotline on 01724 405060 or email: *construction@tatasteel.com*

Richard Laffan

Carol Micklethwaite

Richard Stewart

Paul Windsor



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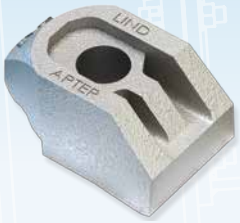

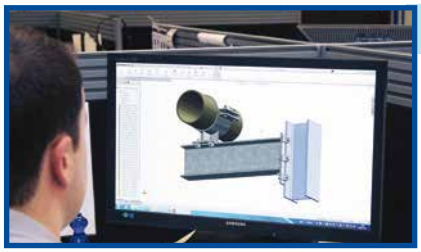

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Resistance factors of Eurocode 3

Load factors and their combinations were reviewed in NSC November 2012 and January 2013. In this article Alastair Hughes switches attention to γ_M.

Introduction

Overall Eurocode safety factors are the product of load factors (by which actions are multiplied) and so-called material factors (by which resistance is divided). Simple in principle, but less so in practice. This article argues that γ_M should really be described as the resistance factor and explores some of the ways it can vary.

Here is an extract from EN 1990's list of symbols, as a reminder that these subscripts are case sensitive:

γ	Partial factor (safety or serviceability)
γ_f	Partial factor for actions, which takes account of the possibility of unfavourable deviations of the action values from the representative values
γ_F	Partial factor for actions, also accounting for model uncertainties and dimensional variations
γ_g	Partial factor for permanent actions, which takes account of the possibility of unfavourable deviations of the action values from the representative values
γ_G	Partial factor for permanent actions, also accounting for model uncertainties and dimensional variations
γ_m	Partial factor for a material property
γ_M	Partial factor for a material property, also accounting for model uncertainties and dimensional variations
γ_q	Partial factor for variable actions, which takes account of the possibility of unfavourable deviations of the action values from the representative values
γ_Q	Partial factor for variable actions, also accounting for model uncertainties and dimensional variations
γ_{Rd}	Partial factor associated with the uncertainty of the resistance model
γ_{Sd}	Partial factor associated with the uncertainty of the action and/or action effect model

Material factor or resistance factor?

Only γ_m can truly be described as a material factor. γ_M accounts not just for understrength material but also for undersize members and 'model uncertainties'. Similarly, load (action) factors with upper case subscripts F/G/Q are supposed to account for 'model uncertainties' and the possibility that a floor screed, for instance, might be cast thicker than what is dimensioned on the drawing.

EN 1993 could have taken the lower case option, together with γ_{Rd} and γ_{Sd} factors. But it doesn't. All its partial factors have upper case subscripts. The responsibility for 'model uncertainties' is shared among them (along with the covert factor implied by treating 'guaranteed minimum' strength values as if they were characteristic). 'Model uncertainties' might as well be interpreted as 'anything else the safety factor might be called upon to cover', and it doesn't profit us to inquire and apportion so long as sufficient of an overall safety factor is there when needed.

That said, some types of failure are considered to deserve higher defences than others, so differential resistance factors are part of the framework.

It would appear that the originators of EN 1993 envisaged three classes of resistance, each with its own γ_M:

- Pure yielding (governed by f_y) – use γ_{M0}
- Buckling (influenced by slenderness) – use γ_{M1}
- Fracture or rupture (governed by f_u) – use γ_{M2}

each with its own unchanging value. But if this was the intention it was subverted when the subcommittees got to work on their respective Parts.

In the early stages it was proposed that γ_{M0} and γ_{M1} should both be 1.1 and γ_{M2} should be set at 1.25, but around 1995 it was decided that both γ_{M0} and γ_{M1} could safely be reduced to 1, bearing in mind the covert factor referred to above. These are today's recommended values (RVs) in EN 1993-1-1, for buildings made of regular steel. For stainless steel, EN 1993-1-4 retains 1.1 for both γ_{M0} and γ_{M1}.

From a practical designer's point of view, it is rather important that γ_{M0} and γ_{M1} share a common value. Otherwise, there would be abrupt and inexplicable changes in design resistance. In effect, a cliff edge at the extremity of the plateau of the buckling curve.

Despite this, as anyone who designs bridges will be aware, 1.1 has been retained as the RV for γ_{M1} in Part 2 of the Standard (EN 1993-2). Of course the steel doesn't know whether it's in a bridge or a building. But bridge designers can't forget the buckling-induced box girder problems, whereas few building designers could recall a single failure of a column in a building in other than the most exceptional circumstances (though this may owe something to our habitual conservatism in the assessment of buckling lengths and floor loads). It's almost as if the bridge community were a separate nation, with a different 'way of life'.

Traps for the unwary

There are other examples of variations in γ_M values between Parts, or even within a Part (EN 1993-1-8 has different γ_{M2} values for different grades of bolt) and new ones are freely

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invented; EN 1993-6, for instance, goes up to γ_{M7}. Users cannot expect the same numbered γ_M to serve a consistent purpose or take a consistent value. EN 1993-1-11 is particularly inventive; witness its expression (6.2) resistance formula for wire ropes and the like:

$$F_{rd} = \min \{F_{uk}/(1.5\gamma_R); F_k/\gamma_R\}$$

in which F_{uk} is the breaking (ultimate tensile) strength and F_k is the proof load. (The second check is not for resistance as such but to keep its design value within the elastic range.) γ_R is described as 'the partial factor' but is actually 1 or even 0.9 (if bending is minimized at the anchorages)! Although there is no γ_M to be seen, the real resistance factor is the 1.5 (or, with bending minimized, 1.35).

National Annexes (NAs) are another potential source of discord, as all γ-factors are identified as parameters for national determination (NDPs).

UK National choice

An example of UK divergence is the γ_{M2} value in EN 1993-1-1, which is 1.1 in place of the RV of 1.25. This is used in expression (6.7) for the net section verification at boltholes:

$$N_{u,Rd} = 0.9A_{net} f_u / \gamma_{M2}$$

For the bolts themselves, γ_{M2} is 1.25 as they are verified according to EN 1993-1-8 whose UK NA-endorsed RV prescribes this higher value. And if that's not confusing enough, turn to EN 1993-1-8 expression (3.9) for so-called block tearing, a combination of rupture and shear at boltholes:

$$V_{eff,1,Rd} = f_u A_{nt} / \gamma_{M2} + (1 / \sqrt{3}) f_y A_{nv} / \gamma_{M0}$$

in which the first part of the formula is virtually a repeat of EN 1993-1-1 (6.7).

Don't ask why the two clauses aren't next to one another in Part 1-1. Do note that the 0.9 in front of f_u has disappeared, and that γ_{M2} is now 1.25, because this is Part 1-8. These variations largely compensate for one another, so the outcome is reasonably similar, but the distinction between the 0.9 above the line (which ought in principle to make the resistance prediction as true as possible, given A_{net} and f_u values exactly as assumed) and the γ_{M2} below (which ought to allow for its predictability, as well as strength, dimensional and other uncertainties) has become decidedly blurred.

Maybe this does not matter too much in normal circumstances, but what about accidental design situations, in which both loads and resistances are unfactored?

A less insular example

As an example of another nation's exercise of national choice, the Danish NA links resistance factors to levels of inspection such that:

$\gamma_{M0} = 1.1\gamma_3$

$\gamma_{M1} = 1.2\gamma_3$

$\gamma_{M2} = 1.35\gamma_3$

The factor γ_3 takes into account the inspection level of the product. 'Tightened' inspection level: $\gamma_3 = 0.95$. 'Normal' inspection level: $\gamma_3 = 1.0$

If these resistance factors seem on the high side, it should be reiterated that what really matters is the overall safety factor. Danish load factors can, in combination, be on the low side, eg $[1.35G_k + 0.0Q_k]$ and $[1.0G_k + 1.5Q_k]$ for Consequence Class* CC2. These values are increased by a factor of 1.1 for tall or important buildings, and reduced by a factor of 0.9 for minor and unpeopled structures.

Thus a CE marked Danish pigshed can be designed with an impressively low overall factor of safety, lower still if subject to third party inspection. In the UK, agricultural buildings were traditionally granted a reduced safety factor in BS5502, but nowadays 'specific levels of protection' seem to be eschewed in the UK implementation** of the Eurocodes for structural design.

Readers may reach their own conclusions as to whether Jutland or Lincolnshire is the better place to be (i) a pig farmer (ii) a steelwork inspector or (iii) a pig.

All credit to the Danes for making their NAs freely available – and in English: ***http://www.eurocodes.dk/en/national-annexes/~/media/0905AF3609EF46F1A611CB2D1903F22F.ashx***

As an alternative to the interpretation offered above, here is the Danish view of the three classes of resistance:

- Warning of failure with resistance to spare – use γ_{M0}
- Warning of failure without spare resistance – use γ_{M1}
- Failure without warning – use γ_{M2}

Conclusions

Structural safety is our raison d'etre as a profession, but as with religion we don't all see eye to eye. The Eurocode priesthood has not always maintained discipline within its own ranks, and national hierarchies have been both lamentable and laudable in their assertions of independence. All this from the best of motives on all sides.

Users, especially those who operate across borders, just have to keep their wits about them.

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* Not to be confused with the similarly (but oppositely!) numbered Consequence Classes of EN 1090-2, which are used in the determination of Execution Class.

** A prominent exception is for masts and towers in BS EN 1993-3-1 Appendix A which introduces 'reliability classes' – consequence classes by another name – leading to load factor variations in the region of 10% upwards or downwards. The principle (but not every one of the RVs) is endorsed by its UK NA. As the Standard itself points out, load factor stipulations ought by rights to be in EN 1990. Not all towers are made of steel.

Belmont, Lincolnshire (at 387.5 m the tallest structure in the EU before it was shortened in 2010)

AD 377
Placement of headed stud shear connectors in troughs of profiled steel sheets with a central stiffener

Some types of profiled steel sheets (PSS) have a central stiffener in the trough, which makes it impossible to place the headed stud(s) centrally in the trough. This advisory desk note clarifies the existing guidance regarding the position of studs in the troughs of PSS with central stiffeners. Clause 6.6.5.8(3) of BS EN 1994-1-1:2004[1] states that in this case the studs should be placed alternately on the two sides of the trough ('favourable' and 'unfavourable' positioning), throughout the length of the span. SCI has already provided guidance in revised Publication P300[2] (Section 5.3.1 on page 68/69 and Figure 5.9 (a), (b) and (c)) and NCCI PN001a-GB[3] that complements BS EN 1994-1-1:2004 provisions, by advising that the studs should be placed in the 'favourable' side of the trough (Figure 5.9 (c) of SCI P300) in order to have the best possible results in terms of resistance and ductility. 'Favourable' is defined as the side of the trough closer to the nearer support so that the zone of concrete in compression in front of the stud is larger than that behind the stud. This requires a change in stud position at mid-span of a uniformly loaded, simply supported beam. It is believed that the reason why this was excluded from BS EN 1994-1-1:2004 was related to the possible errors that might occur on-site with regard to identifying the 'favourable' side for welding the studs. It is also considered that the proposed 'staggered' arrangement (Figure 5.9 (b) in SCI P300), in which pairs of studs are welded on the 'favourable' and 'unfavourable' sides of the trough, would be equivalent to having two studs placed in the central position.

Designers are still advised to place the studs (single or pairs) in the 'favourable' side, when profiled steel sheets with a central stiffener are used, as indicated in SCI P300 (Figure 5.9 (c)), which will lead to the optimum performance. When pairs of studs are used, if it is not possible to place both in the 'favourable' position, then a 'staggered' pattern within the trough may also be adopted.

Contact: **Dr Eleftherios Aggelopoulos**
Tel: **01344 636525**
Email: **advisory@steel-sci.com**

1. BS EN 1994-1-1:2004 (Incorporating corrigendum April 2009) Eurocode 4 – Design of composite steel and concrete structures – Part 1-1: General rules and rules for buildings.
2. Rackham JW, Couchman GH and Hicks SJ (2009) Composite Slabs and Beams using Steel Decking: Best Practice for Design and Construction (Revised Edition). Publication P300, Steel Construction Institute, Ascot, Berkshire.
3. Steel Construction Institute (2010) NCCI: Resistance of headed stud shear connectors in transverse sheeting (PN001a-GB). *http://www.steel-ncci.co.uk.*

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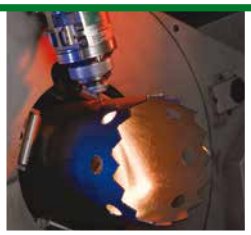

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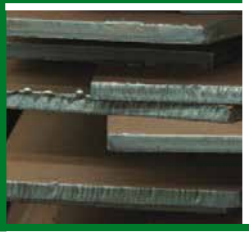

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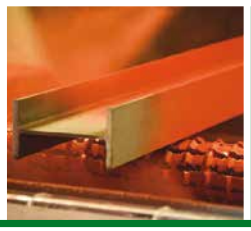

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BS EN 1991-4:2006
Eurocode 1. Actions on structures. Silos and tanks
CORRIGENDUM 3

BRITISH STANDARDS UNDER REVIEW

BS EN ISO 9015-2:2011
Destructive tests on welds in metallic materials. Hardness testing. Microhardness testing of welded joints

BS EN ISO 9018:2003
Destructive tests on welds in metallic materials. Tensile test on cruciform and lapped joints

BS EN ISO 17637:2011
Non-destructive testing of welds. Visual testing of fusion-welded joints

BS EN ISO 17638:2009
Non-destructive testing of welds. Magnetic particle testing

NEW WORK STARTED

EN 1991-1-3:2003/A1
Eurocode 1. Actions on structures. General actions. Snow loads

EN 1991-1-7:2006/A1
Eurocode 1. Actions on structures. General actions. Accidental actions

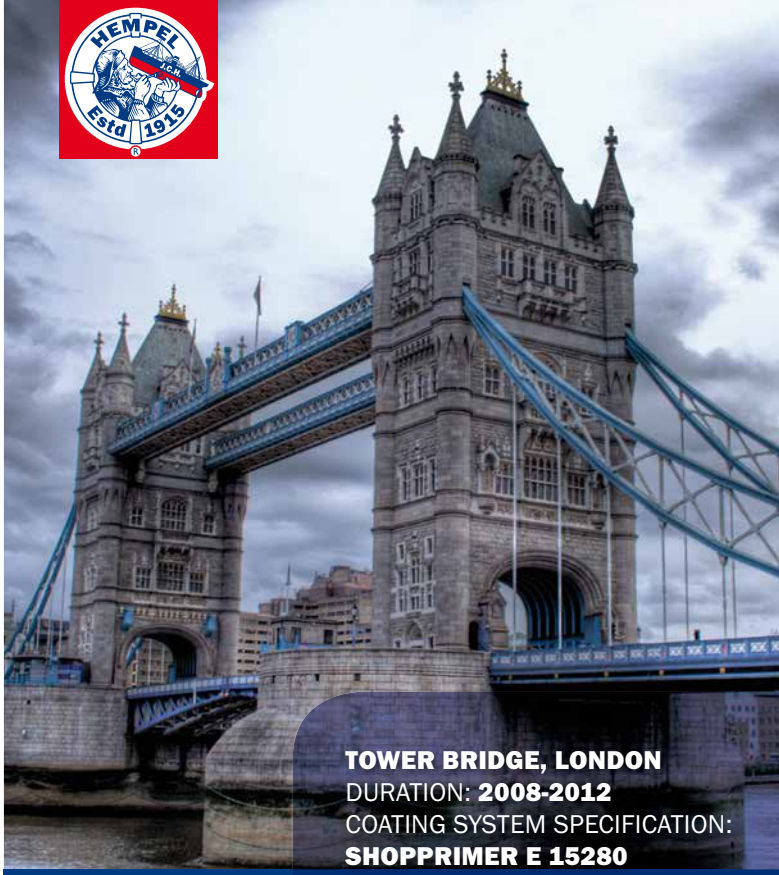
EN 10139
Cold rolled uncoated mild steel narrow strip for cold forming. Technical delivery conditions
Will supersede BS EN 10139:1998

ISO 636
Welding consumables. Rods, wires and deposits for tungsten inert gas welding of non-alloy and fine-grain steels. Classification
Will supersede BS EN ISO 636:2008

ISO 1071
Welding consumables. Covered electrodes, wires, rods and tubular cored electrodes for fusion welding of cast iron. Classification
Will supersede BS EN ISO 1071:2003

ISO 3581
Welding consumables. Covered electrodes for manual metal arc welding of stainless and heat-resisting steels. Classification
Will supersede BS EN ISO 3581:2012

ISO 17632
Welding consumables. Tubular cored electrodes for gas shielded and non-gas shielded metal arc welding of non-alloy and fine grain steels. Classification
Will supersede BS EN ISO 17632:2008



TOWER BRIDGE, LONDON
DURATION: **2008-2012**
COATING SYSTEM SPECIFICATION:
SHOPPRIMER E 15280
HEMPADUR MASTIC 45880
HEMPATHANE HS 55810

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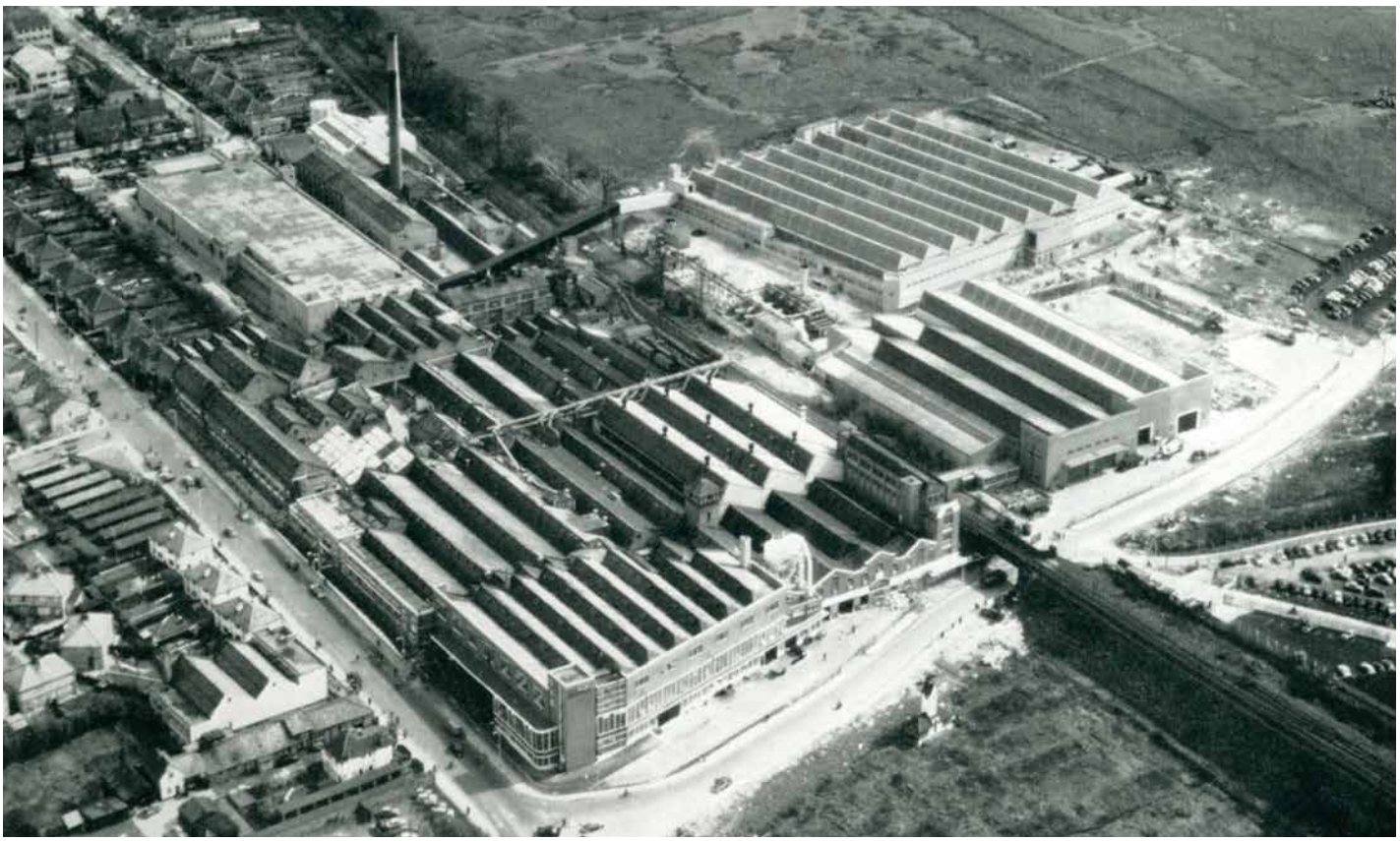
The Adaptability of Structural Steelwork

Sun Printers Ltd, Watford

FROM BUILDING WITH STEEL AUGUST 1963



Aerial view showing reconstruction of the Watford works of Sun Printers Ltd.

The reconstructed and extended Watford works of Sun Printers Limited have attracted visitors from the printing industries of the United States, the Soviet Union, Germany, Japan, Switzerland and indeed many other countries throughout the world.

The first stage in the programme involved raising the existing roofs and consulting basements under 14,500 sq. ft. of the existing factory to accommodate large new printing presses. The existing presses had to be kept in operation in half the area throughout the work.

The new high roof was supported in 27 twin lattice stanchions extending from basement to 28 ft. 6 in. above the main factory floor level. The stanchions were constructed so as to allow temporary free passage of the existing gutters which remained in position to serve the old roof until the new roof was completed and watertight.

The building work progressed in six distinct operations. Where existing printing presses had to be kept in operation they were protected by dustproof and watertight screens; the old roof was left in position during building operations and the new roofs rolled over the top.

On completion of the new roofs the presses were then shut down and covered over for a few days while the old roofs were dismantled. The whole operation was carried out in approximately 15 months.

While this work of raising the roofs was going on, a steel lattice frame had to be erected over them to carry the 150-ft.-long 7-ft.-diameter solvent collection ductwork. This ductwork had to be carried across the railway line to a new absorber plant erected on the other side.

Details of roof design in single-storey factory, showing unimpaired northlight and accommodation for ventilation ductwork

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Steel lattice frame carrying the solvent collection ductwork over the roofs

The first stage in the reconstruction of the printing works involved raising twin roof stanchions to allow temporary passage of existing gutters

During the period of this development various basement excavation works were carried out. These sometimes involved underpinning live printing machinery, but in the main this work was done by screening off the existing factory at ground floor level and excavating from ground level down to new basement level. Temporary arrangements were made to underpin the existing roof stanchions as the work proceeded and these were picked up on the new ground floor steelwork during the course of erection.

The next stage of development was to construct a large process printing block of some 75,000 sq. ft. designed ultimately to have 4 storeys, although only two were constructed at this stage. The design of this building, carried out in conjunction with the London firm of consulting engineers Walter C. Andrews & Partners, was unusual in that the Vierendeel girder, very seldom used in this country, was adopted as the basis of the structural design. This building is an excellent example of the economical use of structural steelwork in conjunction with reinforced concrete.

This combination was adopted to meet the basic requirements of the building which demanded a wide column spacing and clear headroom with no beams, as well as accommodation for a multiplicity of services and drainage pipework and full ventilation ductwork, without the dust traps these services usually involve.

For these reasons a steel Vierendeel girder design 4 ft. 6 in. deep was used on a column grid of 30 ft. by 27 ft. with girders spaced at 9-ft. centres. Columns had steel angle cores to facilitate erection of the main structure and were finally enclosed with reinforced concrete.

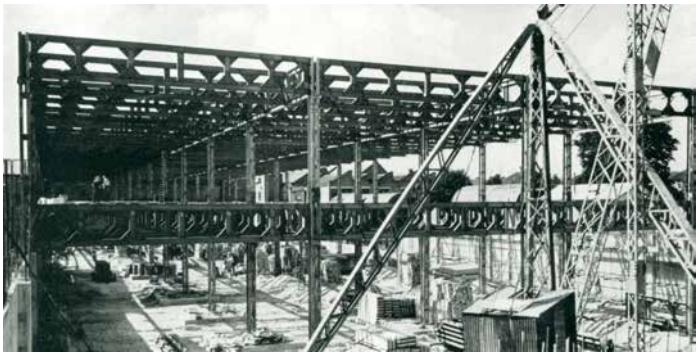
The top and bottom booms of the girder were used to support preformed reinforced concrete floor sections with cast in-situ areas. This afforded homogeneity of construction and created a box formation to give a completely flat ceiling with void space to accommodate all service pipework, ductwork etc.

Running concurrently with the above work was the extension of the paper warehouse department which had previously been constructed in reinforced concrete. Owing to the restricted time element it was decided to construct this extension of some 12,000 sq. ft. using a steel portal truss type design of 45 ft. span supporting a 1½ ton overhead travelling crane. The hole of this work was carried out in 4½ months.

The overall development work was concluded with a single-storey factory on adjacent land on the south side of the railway. This building provided some 100,000 sq. ft. for general printing purposes. Considerable thought was given to the roof design, the requirement being unimpaired northlight with accommodation for ventilation ductwork.

To meet these requirements an unusual type of northlight truss was designed to span 32 ft., the south slope of which formed a truss supported on the top and bottom boom of a lattice girder spanning 48 ft. The south slope was undersheeted with a Melamine-faced plasterboard to give a smooth soffit and provide a void space for services.

Connecting this last development with the main building on the north side of the railway and enclosed conveyor structure some 320 ft. long was erected which also carries service piping from the main boiler house. Here the most interesting construction was the section of approximately 90 ft. spanning the railway land, a 50 ft. section of which had to be constructed and clad on the ground alongside the track and hoisted into position during a Sunday when the railway line could be closed.



Above: Basement excavation work was carried out without interruption to normal factory production. Right: The Vierendeel girder was adopted as the base of structural design in the process printing block since the basic requirement of the building was for wide column spacing, no beams and room for and ductwork.

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Steelwork contractors for buildings

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 Director General, BCSA, 4 Whitehall Court, London SW1A 2ES
Tel: 020 7747 8121 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

- **FPC** Factory Production Control certification to BS EN 1090-1
  - **1** – Execution Class 1
  - **2** – Execution Class 2
  - **3** – Execution Class 3
  - **4** – Execution Class 4
- **QM** Quality management certification to ISO 9001
- **SCM** Steel Construction Sustainability Charter
  (● = Gold, ● = Silver, ● = Member)

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	FPC	SCM	Guide Contract Value (1)
A C Bacon Engineering Ltd	01953 850611			●	●		●										2		Up to £2,000,000
A J Stead Ltd	01653 693742			●	●					●	●			●	●				Up to £100,000
Adey Steel Ltd	01509 556677				●	●	●	●		●	●			●	●	✔		●	Up to £2,000,000
Adstone Construction Ltd	01905 794561			●	●	●	●									✔	2	●	Up to £3,000,000
Advanced Fabrications Poyle Ltd	01753 653617				●	●	●	●	●	●	●				●				Up to £800,000
AJ Engineering & Construction Services Ltd	01309 671919			●	●					●	●			●	●	✔			Up to £1,400,000
Angle Ring Company Ltd	0121 557 7241												●			✔			Up to £1,400,000
Apex Steel Structures Ltd	01268 660828		●		●	●	●			●	●			●					Up to £1,400,000
Arminhall Engineering Ltd	01799 524510	●			●					●	●			●	●				Up to £200,000
Arromax Structures Ltd	01623 747466	●		●	●	●	●	●	●	●	●	●		●	●		2		Up to £800,000
ASA Steel Structures Ltd	01782 566366			●	●	●	●			●	●			●	●				Up to £800,000*
ASD Westok Ltd	0113 205 5270												●			✔	2		Up to £6,000,000
ASME Engineering Ltd	020 8966 7150				●					●	●			●	●			●	Up to £800,000*
Atlas Ward Structures Ltd	01944 710421		●	●	●	●	●	●	●	●	●	●		●	●	✔	4	●	Above £6,000,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●	●	●				●			●	●				Up to £1,400,000
Austin-Divall Fabrications Ltd	01903 721950			●	●		●	●		●	●			●	●				Up to £800,000
B D Structures Ltd	01942 817770			●	●	●	●				●	●		●					Up to £400,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●				✔			Up to £1,400,000
Barnshaw Section Benders Ltd	01902 880848												●			✔	4		Up to £800,000
BHC Ltd	01555 840006	●	●	●	●	●	●	●			●	●		●	●	✔	2		Above £6,000,000
Billington Structures Ltd	01226 340666		●	●	●	●	●	●	●	●	●	●		●		✔	4	●	Above £6,000,000
Border Steelwork Structures Ltd	01228 548744			●	●	●	●			●	●				●				Up to £3,000,000
Bourne Construction Engineering Ltd	01202 746666		●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	●	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●		●	●	●	●	●	●	●	●			●	●	✔			Up to £3,000,000
Builders Beams Ltd	01227 863770				●					●				●	●	✔			Up to £400,000
Cairnhill Structures Ltd	01236 449393	●			●	●	●	●	●	●				●	●	✔	4	●	Up to £3,000,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●		●	●	●		●	●	✔	4	●	Up to £6,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	●	●	●		●		✔	4	●	Above £6,000,000*
CMF Ltd	020 8844 0940				●		●	●		●	●				●	✔			Up to £6,000,000
Cook Fabrications Ltd	01303 890040				●					●	●			●	●				Up to £800,000
Cordell Group Ltd	01642 452406	●			●	●	●	●	●	●	●					✔			Up to £3,000,000
Coventry Construction Ltd	024 7646 4484			●	●	●	●	●	●	●	●			●	●				Up to £800,000
D H Structures Ltd	01785 246269			●	●		●				●			●					Up to £100,000
DGT Structures Ltd	01603 308200			●	●	●	●					●		●		✔			Up to £2,000,000
Discain Project Services Ltd	01604 787276				●					●	●				●	✔			Up to £1,400,000
Duggan Steel Ltd	00 353 29 70072		●	●	●	●	●	●			●								Up to £4,000,000
ECS Engineering Services Ltd	01773 860001	●		●	●	●	●	●	●	●	●			●	●	✔	3		Up to £2,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●		✔	4	●	Up to £6,000,000
EvadX Ltd	01745 336413			●	●	●	●	●	●	●	●	●				✔		●	Up to £3,000,000
Fisher Engineering Ltd	028 6638 8521		●	●	●	●	●	●	●	●	●	●				✔	4	●	Above £6,000,000
Fourbay Structures Ltd	01603 758141			●	●					●	●			●	●				Up to £1,400,000
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●			●								Up to £3,000,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●					Up to £800,000
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 £3,000,000
Company name	**Tel**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**	**M**	**N**	**Q**	**R**	**S**	**QM**	**FPC**	**SCM**	**Guide Contract Value (1)**

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	SCM	Guide Contract Value (1)
H Young Structures Ltd	01953 601881			●	●	●	●	●			●			●	●	✔			Up to £2,000,000
Had Fab Ltd	01875 611711				●				●	●	●				●	✔			Up to £2,000,000
Hambleton Steel Ltd	01748 810598		●	●	●	●	●	●				●		●		✔			Up to £1,400,000
Harry Marsh (Engineers) Ltd	0191 510 9797			●	●	●	●				●	●			●	✔			Up to £1,400,000
Henry Smith (Constructional Engineers) Ltd	01606 592121			●	●	●	●	●											Up to £3,000,000
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●				Up to £3,000,000
Hills of Shoeburyness Ltd	01702 296321									●				●	●				Up to £800,000
J Robertson & Co Ltd	01255 672855									●	●				●				Up to £200,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●					●		●			4		Up to £6,000,000*
John Reid & Sons (Strucsteel) Ltd	01202 483333		●	●	●	●	●	●	●	●	●	●		●					Up to £6,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445			●	●	●	●	●	●	●	●	●		●	●	✔		●	Up to £2,000,000
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●					✔	2		Up to £2,000,000
Luxtrade Ltd	01902 353182									●	●			●		✔			Up to £800,000
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	●	●	●	●	●	●	●	●	●	●	●	●	●		✔	4	●	Above £6,000,000
Mackay Steelwork & Cladding Ltd	01862 843910			●	●		●			●	●			●	●	✔	4		Up to £800,000
Maldon Marine Ltd	01621 859000				●	●		●	●	●					●				Up to £1,400,000
Mifflin Construction Ltd	01568 613311		●	●	●	●	●				●								Up to £3,000,000
Newbridge Engineering Ltd	01429 866722			●	●	●	●								●	✔			Up to £1,400,000
Nusteel Structures Ltd	01303 268112						●	●	●	●						✔	4		Up to £4,000,000
On Site Services (Gravesend) Ltd	01474 321552				●		●	●		●	●				●				Up to £100,000
Overdale Construction Services Ltd	01656 729229			●	●		●	●			●				●				Up to £400,000
Paddy Wall & Sons	00 353 51 420 515			●	●	●	●	●	●	●	●								Up to £6,000,000
Painter Brothers Ltd	01432 374400								●		●				●	✔		●	Up to £6,000,000
Pencro Structural Engineering Ltd	028 9335 2886			●	●	●	●	●	●		●			●	●	✔			Up to £2,000,000
Peter Marshall (Steel Stairs) Ltd	0113 307 6730									●					●				Up to £800,000
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●				Up to £1,400,000
Remnant Plant Ltd	01594 841160				●		●	●	●	●	●				●	✔			Up to £400,000
Rippin Ltd	01383 518610			●	●	●	●	●						●	●				Up to £1,400,000
S H Structures Ltd	01977 681931						●	●	●	●		●				✔	4		Up to £3,000,000
SDM Fabrication Ltd	01354 660895			●	●	●	●				●			●	●				Up to £200,000
Severfield-Watson Structures Ltd	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	●	Above £6,000,000
Shipley Fabrications Ltd	01400 251480			●	●	●	●		●	●	●			●	●				Up to £1,400,000
SIAC Butlers Steel Ltd	00 353 57 862 3305		●	●	●	●	●	●	●		●	●				✔	2		Above £6,000,000
SIAC Tetbury Steel Ltd	01666 502792			●	●	●	●		●		●	●		●					Up to £400,000*
Snashall Steel Fabrications Ltd	01300 345588			●	●	●	●	●			●				●				Up to £1,400,000
South Durham Structures Ltd	01388 777350			●	●	●				●	●	●			●				Up to £800,000
Southern Fabrications (Sussex) Ltd	01243 649000				●					●	●			●	●				Up to £800,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●				●			●	●	✔	2		Up to £200,000
Traditional Structures Ltd	01922 414172		●	●	●	●	●	●	●		●	●		●	●	✔			Up to £2,000,000
TSI Structures Ltd	01603 720031			●	●	●	●												Up to £1,400,000
Tubecon	01226 345261						●	●	●	●				●	●	✔		●	Above £6,000,000*
W & H Steel & Roofing Systems Ltd	00 353 56 444 1855			●	●	●	●	●						●	●				Up to £3,000,000
W I G Engineering Ltd	01869 320515				●					●					●				Up to £200,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✔			Up to £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	●	●	●	●	●	●	●	●	●	●	●		●		✔	4	●	Above £6,000,000
Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	SCM	Guide Contract Value (1)

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
Highways Agency	08457 504030
Kier Construction Ltd	01767 640111

Company name	Tel
Roger Pope Associates	01752 263636
Sandberg LLP	020 7565 7000
SUM Ltd	0113 242 7390

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

CE CE Marking compliant, where relevant:
M manufacturer (products CE Marked)
D/I distributor/importer (systems comply with the CPR)
N/A CPR not applicable

SCM Steel Construction Sustainability Charter
● = Gold, ● = Silver, ● = Member

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM
AceCad Software Ltd	01332 545800		●								N/A	
Albion Sections Ltd	0121 553 1877	●									M	
Andrews Fasteners Ltd	0113 246 9992									●	M	
Arcelor Mittal Distribution – Birkenhead	0151 647 4221								●		D/I	
Arcelor Mittal Distribution - Scunthorpe	01724 810810								●		D/I	
Arcelor Mittal Distribution – South Wales	01633 627890								●		D/I	
ASD metal services	0113 254 0711								●		D/I	
Ayrshire Metal Products (Daventry) Ltd	01327 300990	●									M	

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM
BAPP Group Ltd	01226 383824									●	M	
Barnshaw Plate Bending Centre Ltd	0161 320 9696	●									N/A	
Barrett Steel Ltd	01274 682281								●		D/I	
BW Industries Ltd	01262 400088	●									M	
Cellbeam Ltd	01937 840600	●									M	
Cellshield Ltd	01937 840600							●			N/A	
CMC (UK) Ltd	029 2089 5260								●		D/I	
Composite Profiles UK Ltd	01202 659237	●									D/I	

Steelwork contractors for bridgeworks

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

AS Ancilliary structures in steel associated with bridges, footbridges or sign gantries (eg grillages, purpose-made temporary works)
QM Quality management certification to ISO 9001
FPC Factory Production Control certification to BS EN 1090-1
1 – Execution Class 1 2 – Execution Class 2
3 – Execution Class 3 4 – Execution Class 4
SCM Steel Construction Sustainability Charter
(● = Gold, ● = Silver, ● = Member)

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.

BCSA steelwork contractor member	Tel	FG	PG	TW	BA	CM	MB	RF	AS	QM	FPC	NHSS 19A	NHSS 20	SCM	Guide Contract Value (1)
Access Design & Engineering	01952 685162	●						●	●	✓					Up to £3,000,000
Briton Fabricators Ltd	0115 963 2901	●	●	●	●	●	●	●	●	✓			✓		Up to £3,000,000
Cairnhill Structures Ltd	01236 449393	●	●	●	●			●	●	✓	4			●	Up to £3,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	✓	4	✓	✓	●	Above £6,000,000*
Four-Tees Engineers Ltd	01489 885899	●	●	●	●		●	●	●	✓	3		✓	●	Up to £2,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445	●	●	●	●			●	●	✓				●	Up to £2,000,000
Mabey Bridge Ltd	01291 623801	●	●	●	●	●	●	●	●	✓	4	✓	✓	●	Above £6,000,000
Nusteel Structures Ltd	01303 268112	●	●	●	●	●	●	●	●	✓	4	✓	✓		Up to £4,000,000
Painter Brothers Ltd	01432 374400	●		●					●	✓				●	Up to £6,000,000
Remnant Plant Ltd	01594 841160	●	●	●					●	✓					Up to £400,000
S H Structures Ltd	01977 681931	●		●	●	●			●	✓	4		✓	●	Up to £3,000,000
Severfield-Watson Structures Ltd	01204 699999	●	●	●	●	●	●	●	●	✓	4		✓	●	Above £6,000,000
Non-BCSA member															
Allerton Steel Ltd	01609 774471	●	●	●	●	●	●	●	●	✓					Up to £1,400,000
Cimolai SpA	01223 350876	●	●	●	●	●	●	●	●	✓					Above £6,000,000
Concrete & Timber Services Ltd	01484 606416	●	●	●	●	●	●		●	✓				●	Up to £800,000
Donyal Engineering Ltd	01207 270909	●						●	●	✓			✓	●	Up to £1,400,000
Francis & Lewis International Ltd	01452 722200							●	●	✓	2			●	Up to £2,000,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456	●	●	●	●	●		●	●	✓					Up to £2,000,000
Hollandia BV	00 31 180 540540	●	●	●	●	●	●	●	●	✓					Above £6,000,000
Interserve Construction Ltd	0121 344 4888							●	●	✓					Above £6,000,000*
Interserve Construction Ltd	020 8311 5500	●	●	●	●		●	●	●	✓					Above £6,000,000*
Lanarkshire Welding Company Ltd	01698 264271	●	●	●	●	●	●	●	●	✓				●	Up to £2,000,000
Millar Callaghan Engineering Services Ltd	01294 217711	●						●	●	✓					Up to £800,000
P C Richardson & Co (Middlesbrough) Ltd	01642 714791	●						●	●	✓					Up to £3,000,000
Varley & Gulliver Ltd	0121 773 2441	●						●	●	✓			✓		Up to £3,000,000

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM
Cooper & Turner Ltd	0114 256 0057									●	M	
CSC (UK) Ltd	0113 239 3000		●								N/A	
Cutmaster Machines (UK) Ltd	01226 707865					●					N/A	
Daver Steels Ltd	0114 261 1999	●									M	
easi-edge Ltd	01777 870901							●			N/A	●
Fabsec Ltd	0845 094 2530	●									N/A	
FabTrol Systems UK Ltd	01274 590865		●								N/A	
Ficep (UK) Ltd	01942 223530					●					N/A	
FLI Structures	01452 722200	●									M	●
Forward Protective Coatings Ltd	01623 748323						●				N/A	
Goodwin Steel Castings Ltd	01782 220000	●									N/A	
Graitec UK Ltd	0844 543 8888		●								N/A	
Hadley Group Ltd	0121 555 1342	●									M	●
Hempel UK Ltd	01633 874024						●				N/A	
Highland Metals Ltd	01343 548855						●				N/A	
Hilti (GB) Ltd	0800 886100									●	M	
Hi-Span Ltd	01953 603081	●									M	●
International Paint Ltd	0191 469 6111						●				N/A	●
Jack Tighe Ltd	01302 880360						●				N/A	
Jamestown Cladding & Profiling Ltd	00 353 45 434288	●									M	
John Parker & Sons Ltd	01227 783200								●	●	D/I	
Jotun Paints (Europe) Ltd	01724 400000						●				N/A	
Kaltenbach Ltd	01234 213201					●					N/A	

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM
Kingspan Structural Products	01944 712000	●									M	●
Lindapter International	01274 521444									●	M	
Metsec Plc	0121 601 6000	●									M	●
MSW Structural Floor Systems	0115 946 2316	●									D/I	
Murray Plate Group Ltd	0161 866 0266								●		D/I	
National Tube Stockholders Ltd	01845 577440								●		D/I	
Peddinghaus Corporation UK Ltd	01952 200377					●					N/A	
PPG Performance Coatings UK Ltd	01773 814520						●				N/A	
Prodeck-Fixing Ltd	01278 780586	●									D/I	
Rainham Steel Co Ltd	01708 522311								●		D/I	
Sherwin-Williams Protective & Marine Coatings	01204 521771						●				M	●
Sika Ltd	01707 384444						●				M	
Structural Metal Decks Ltd	01202 718898	●									M	●
Tata Steel	01724 404040				●						M	
Tata Steel Distribution UK & Ireland	01902 484000								●		D/I	
Tata Steel Ireland Service Centre	028 9266 0747								●		D/I	
Tata Steel Service Centre Dublin	00 353 1 405 0300								●		D/I	
Tata Steel Tubes	01536 402121				●						M	
Tata Steel UK Panels & Profiles	0845 3088330	●									M	
Tekla (UK) Ltd	0113 307 1200		●								N/A	
Tension Control Bolts Ltd	01948 667700						●			●	M	
Wedge Group Galvanizing Ltd	01909 486384						●				N/A	

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Steel Knowledge

design team integration | why does it matter?

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ARCHITECTURAL DESIGN → DESIGN TEAM → CONSTRUCTION TEAM

"Personally I believe it's essential for the designer and fabricator to talk. We had some really good discussions on the execution sequence of the structure and redesign of the site splices for the Town Quay Bridge project, Devon"

Andy Mathews, Senior Bridge Engineer
at Devon County Council

Wednesday 6th November 2013
The Tower of London

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