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# NSC

New City icon

Jan/Feb 2013

Vol 21 No.1

Interchange at Mansfield

Steel takes podium at St Pancras

Student flats for Manchester

County council HQ extends

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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.

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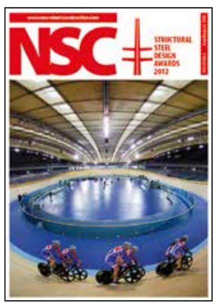


**Cover Image**
**Mansfield bus station**
Client: Nottinghamshire County Council
Architect: Nottinghamshire County Council
Steelwork contractor: Caunton Engineering
Steel tonnage: 220t

BCSA

TATA STEEL

SCI Steel Knowledge



Jan/Feb 2013 Vol 21 No 1



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

# New focus for schools

Nick Barrett - Editor

At this time last year, in the first issue of NSC of 2012, we looked forward against a fairly gloomy economic backdrop to school building resuming after the halt called by the government to the Building Schools for the Future (BSF) programme. As you can see from the special supplement distributed with this first issue of NSC of 2013 – and with a range of other key construction weekly and monthly magazines – those hopes are being realised.

Important decisions have now been made relating to how the Priority School Building Programme (PSBP) that replaced BSF will be delivered, allowing work to get under way again in a sector of vital demand for steel construction – around 70% of schools are steel framed, accounting for about 10% of the constructional steelwork used in the UK.

This does not mean that the happy days of BSF are entirely with us again; investment in school building is unlikely to be on as ambitious a scale as the BSF programme was for a very long time, if ever. There is a new focus on cost effectiveness and design ambitions have been scaled back. Yet architects, structural engineers, contractors and the steelwork contractors who they work with are confident of continuing to deliver high quality educational facilities of all types – primary and secondary schools, higher and further education buildings and student accommodation – to match what the UK finances can afford. Our supplement contains plenty of examples of this.

Steel's proven cost effectiveness, high sustainability credentials and ability to create the light, airy, friendly, modern and flexible spaces that education thrives in will doubtless mean that the education that most of the UK's children benefit from – still one of the best in the world, despite any faults – will take place in a steel framed building. Something to be proud of.

Detailed background and design advice on the use of steel in education can of course be found on the new steel construction sector website – or online encyclopaedia – at *www.steelconstruction.info*. This is proving to be an invaluable first stop for anyone needing practical information, or a link to where else to go to find it, on any steel construction related topic. There is an entire section dedicated to the use of steel in education which will repay a visit, and we have an article outlining what is available on the website for the various sectors on page 20 of this issue of NSC.

NSC

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# BCSA working group to aid BIM awareness

Following the government's announcement that it will require collaborative 3D Building Information Modelling (BIM) on its projects by 2016, the BCSA has established a BIM working group.

The aim of the group is to develop a simple working definition for Level II BIM and identify the software, competence and systems needed to comply with this level.

"The awareness of BIM has been increasing but there is still a significant part of the construction supply chain that is unaware of it, doesn't fully understand it and feels the cost of implementing it is too high," said Dr David Moore, BCSA Director of Engineering.

"However, the vast majority of our members in the steel construction sector are already using BIM techniques."

The group consists of representatives from clients, main contractors, consultants, steelwork contractors and software providers (AceCad, CSC, FabTrol, Graitec and Tekla).

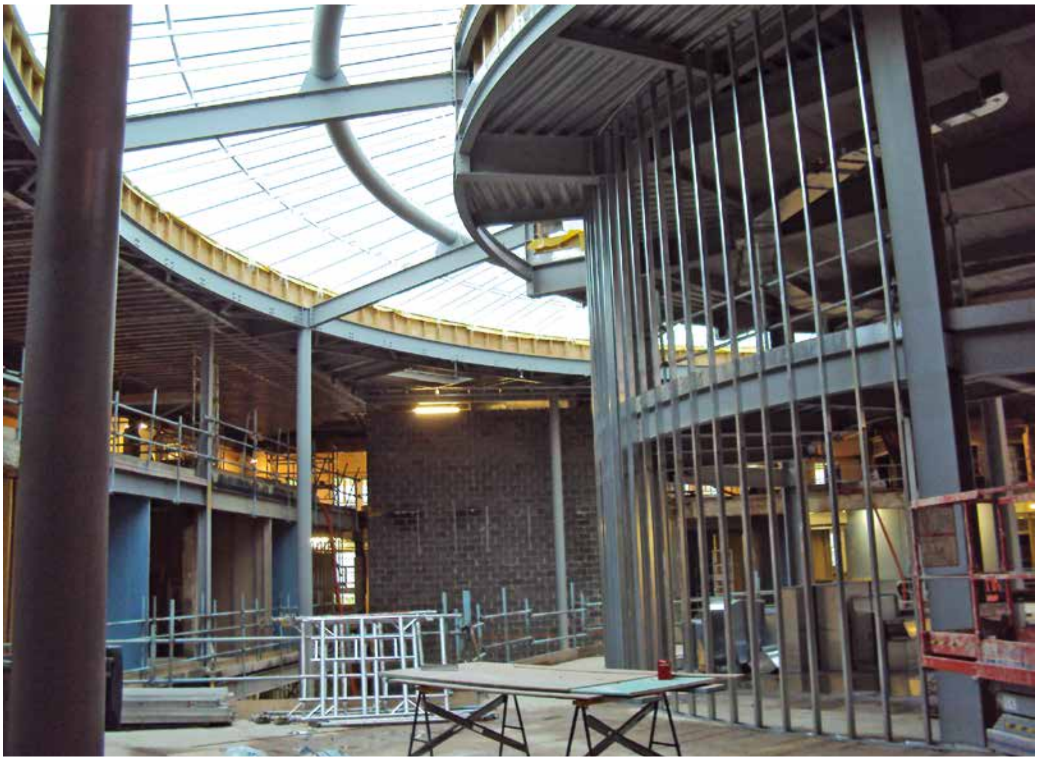
Andrew Bellerby, Managing Director of Tekla (UK) said the software required to achieve Level II BIM exists, but the main problems are seen as cultural and systems related.

"Although the software for BIM implementation is available, our job at Tekla is to make sure clients are using the software to its full capability.

"The steel construction sector has led the way for quite a while in this field, with its use of models and the sharing of information. Although the BIM Group is an educational forum, it will also be a good way of promoting the steel industry's innovative way of working."

The BIM working group will hold its next meeting on 6 February. For more information contact the BCSA.

## Council HQ opens with new steel interior



Derby City Council's headquarters has reopened after an extensive refurbishment programme was completed with the aid of steel construction.

The building, originally built in the late 1930s, has been reconfigured with a steel frame erected to fill up a central courtyard.

The new steel frame connects to the original structure's steelwork and creates a central atrium and new council chamber, as well as more office space.

Steelwork was fabricated, supplied and erected by Fisher Engineering and more than 2,500 individual pieces were used.

The steel was installed in 13 weeks and was erected by an onsite tower crane. This crane lifted the majority of the steel members straight from the delivery trucks and then up and over the existing building. Some larger members were delivered to the central courtyard site through a former ceremonial car entrance.

Main contractor for the project was BAM Construction and the refurbished building meets the BREEAM 'Excellent' rating.

## Leadenhall provides City with another icon

Leadenhall, otherwise known as the 'Cheesegrater', is expected to reach its maximum height of 225m next month (February), as Severfield-Watson Structures erect the final pieces of the structure's 18,000t of steelwork.

The use of structural steelwork has played a key role in the design and construction of the iconic tower. It has a unique building design, with an external mega frame structure providing the lateral stability, rather than a central core, with an offset self-contained service core located on the northern vertical elevation.

The northern core contains lifts, risers, and toilets, and allows the main building to have large open spans with only six internal columns needed for the larger lower levels.

With its distinctive tapering shape the completed building will appear to be leaning away from St Paul's Cathedral. The structure's floorplates will have a variety of sizes ranging from 1,500m$^2$ on the lower levels to 550m$^2$ at the top.

Ground floor to level five is known as The Galleria and will be an open public area linking into nearby St Helen's Square.

Practical completion to the shell and core is scheduled for mid 2014, and the building is set to achieve a BREEAM 'Excellent' rating.

# Future proof viaducts take shape

Weathering steel girders designed to age naturally and reduce future maintenance liability are being installed by Mabey Bridge on two motorway viaducts in the west of England.

The structural steelwork is going in at the Bushley and Ripple viaducts on the M50, which are being demolished and rebuilt on behalf of the Highways Agency. This follows discovery of corrosion to the former viaduct structures caused by water ingress and damaged concrete.

The Bushley structure has seven spans and is 120m long requiring 154t of steel, while the Ripple viaduct is 150m long, consisting of eight spans and with a steel tonnage of 190t.

Replacement of the viaducts forms part of a larger, two year package of highway improvements along the motorway worth £35M.

## Car park creates extra spaces for rail passengers

A new £2.5M car park at Warwick Parkway station has opened, providing rail users with an additional 222 car spaces.

Bourne Parking (part of the Bourne Group) erected 350t of steelwork to build the suspended car park for its client Chiltern Railways.

Rob Brighouse, Chiltern Railways Managing Director, said since the launch of a new service to London Marylebone the number of passengers using the station had increased significantly.

"The new car park is the latest in a series of improvements across our network. By creating over 200 extra spaces at the station it makes it easier than ever to use our services."

Commenting on the finished project, Nick Hayes, Bourne Parking Managing Director, said: "The car park is designed to blend into the landscaping and operation of the station, and provides direct access to the ticket hall and platforms."


## Steelwork regenerates steel town

Approximately 1,200t of structural steelwork is being used to construct the Redcar Leisure and Community Heart, which forms part of a multi million pound redevelopment programme for the north eastern steel town.

Working on behalf of Willmott Dixon, Hambleton Steel is fabricating, supplying and erecting the steel for this project. The frame consists of more than 4,500 steel sections which will be held in place with 41,000 bolts.

The complex will include a six lane, 25m long swimming pool, a training and leisure pool, a dance hall and performance space, a fitness suite, junior gym and sports hall, business and community space as well as car parking and landscaped public spaces.

The local authority, Redcar and Cleveland Council, has a number of steel framed schemes aimed at regenerating the town. A vertical pier, known as the Beacon has been completed, while the Hub, a base for creative and digital industries in being built.

## NEWS IN BRIEF

**The Bourne Group** has been presented with Skanska's 2012 Supply Chain Health and Safety Award. The accolade is awarded to members of Skanska's supply chain who consistently demonstrate excellence in health and safety practices. Bourne's Construction Director, Charlie Rowell said: "When you consider the scale of the projects Skanska regularly deliver, in addition to the number of suppliers they work with, winning this award is a real achievement."

The **BCSA** has formed a new group for cold formed sections to address the ongoing developments in regulations, standards and specifications, in particular the proposal to develop a new European standard. The group includes manufacturers, designers and installers of cold formed sections.

More than 32,000m$^2$ of **Kingspan** Structural Product's multideck 60-V2 has been installed as part of the Two Snowhill project in Birmingham. Ian Oliver, Director of Caunton Engineering, commented: "We have used the Kingspan multideck system on several projects as a result of our longstanding supply chain partnership."

**Tekla** has announced that the latest Tekla BIMsight 1.7 is integrated with a SMART Board interactive display, which is said to be an increasingly common tool used in architecture, engineering and construction. "Users can utilise all the features of Tekla BIMsight, just on a new and exciting device. Walk to the display and touch it, or take a pen and eraser and use them in the way you learned at school. You obviously need a SMART Board, but you don't have to pay anything more for the powerful BIM software," said Jussi Ketoja, Marketing Manager of Tekla Corporation.

**Graitec** has launched version 2013 of its Advance Steel 3D structural detailing software. Said to be designed for steel professionals who require an easy to use 3D detailing software for automating drawing production. Advance Steel is based on the implementation of a digital model (BIM) and automates the creation of drawings and files.

## AROUND THE PRESS

**Construction News**
*29 November 2012*
**King's Cross steps up to the podium**
[Pancras Square] – "There was a six week saving in using steel instead of concrete, which made for a much more comfortable environment to deliver the rest of the project," said Mick Kelly, BAM Construct construction manager.

**Construction News**
*29 November 2012*
**Steel delivers a flexible approach**
[Trinity Square, Gateshead] – Fairhurst partner Ron Bryson says: "Steel gave the flexibility that was needed to incorporate the changing grid patterns and the complex phasing arrangements of the developments to accommodate the constraints of the neighbouring Gateshead shopping streets ….

**Building Design**
*2 November 2012*
**Grater London**
[Leadenhall] – The 16,000 tonne steel superstructure is expected to complete by February. For Watson Steel Structures, the challenge has been meeting the requirements for both precision and aesthetic appearance for such complex connections – some weighing up to 40 tonnes – as well as ensuring that these could be assembled on site to the swift programme.

**The Structural Engineer**
*December 2012*
**Victoria Memorial Museum rehabilitation**
New lightweight floors were put in to tie the walls together, and a steel skeleton was introduced inside the external walls to cope with seismic forces. This is an excellent example of careful and imaginative alterations that have helped to prolong the life of a fine and important building.

**New Civil Engineer**
*6 December 2012*
**Cracking Russian codes**
[Spartak Moscow stadium] – "The snow loading is huge," says Aecom project director Peter Ayres. "So we have some interesting trusses." The roof is steel at its most spectacular – giant steel trusses supported by four interlocking steel mega-trusses, which span back to eight principal support points around the ground.

# SCI announces CE Marking partnership

The Steel Construction Institute (SCI) and Ceram, the international materials technology company, are to work in partnership to deliver a testing and assessment service for clients.

The partnership recognises the relevance of Ceram's testing facilities to the steel sector and in particular its needs for CE marking, as well as the SCI's steel design engineering expertise.

By combining Ceram's facilities with SCI's specialist knowledge of the steel construction sector and its needs, clients will be better served going forward in what seems an ever more complicated regulatory environment.

Ceram has well established structural testing capabilities and has been involved with numerous major projects, including the 2012 Olympic Aquatics Centre.

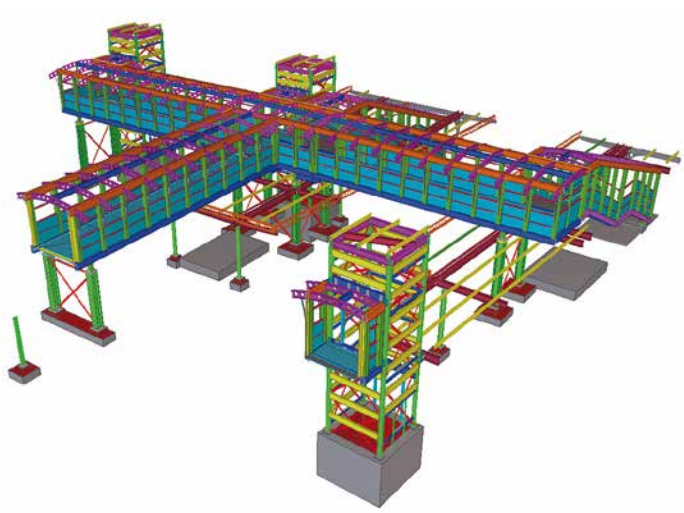
SCI has experience of developing European Technical Approvals to cover unique construction products. A manufacturer can then progress towards CE marking, supported by a Notified Body which undertakes the assessment of factory production control. In partnership with a Notified Body, SCI can assist manufacturers in the CE marking process by developing the necessary European Technical Approval where a harmonized standard does not exist.

## Improved station access for all

A host of important structural steel elements are being supplied and installed by Billington Structures as part of the redevelopment of Thornton Heath station in south London.

Forming part of the national railway improvement programme, also known as Access for All, the £370M scheme will upgrade accessibility at 160 stations around the country with the installation of lifts and ramps for disabled passengers.

Working on behalf of main contractor Spencer Group, Billington is fabricating and erecting approximately 130t of structural steelwork for the project. This comprises of bridge sections, stairs, lift shafts and canopies, all of which will be installed during two rail possessions in January and early March.




## Steel safety system wins recognition

Leach Structural Steelwork won Balfour Beatty's Zero Harm – Supply Chain Award at the contractor's Northern Annual Supply Chain Seminar for 2012.

The steelwork company was nominated for the award for utilising its safe unloading system for its steel on a project in Blackburn.

Ross Sangster, Balfour Beatty Project Manager said: "Leach have continued to provide a proactive approach to zero harm, in particular dealing with offloading steel in a controlled and safe manner. This has resulted in a safety culture spreading through its workforce."

Leach's system was designed by its own engineering department, has been used since October 2006 and is integral to the company's own transport fleet. Used for loading and unloading of steel, it provides harnessed access for the operative, while a safe standing area – used during hoisting – ensures safety at all times.

Ian Wallwork, Leach Structural Steelwork Safety Manager said: "We consider this an outstanding achievement and one which encourages us to continue supporting the policy of a zero harm culture."

# Steelwork transforms former mining town

Structural steelwork is playing a pivotal role in the regeneration of Hednesford in Staffordshire, where a large scale project will revitalise this former coal mining community.

The £50M project includes two adjacent developments, known as Victoria Shopping Park and Chase Gateway. The former consists of a 7,400m² Tesco store, a parade of seven retail units, as well as a new community facility.

Working on behalf of Vinci Construction, Caunton Engineering has fabricated, supplied and erected approximately 1,000t of steel for the Victoria Shopping Park phase.

The Tesco superstore and the retail units opened in November, in time for the festive shopping season. The community facility is expected to open shortly.

At Chase Gateway, a purpose built building has been delivered for Hednesford Bingo and work is nearing completion on a new 1,400m² Aldi store.

Working in conjunction with Cannock Chase Council, St Modwen is delivering the entire regeneration scheme.

## Framed in steel keeps Worcester fit


Olympic rowing medalist Zac Purchase MBE has officially opened the steel framed David Lloyd Leisure Club in Worcester.

Opened in time for the Christmas holidays, the centre (featured in NSC June 2012) benefited from steel's speed of construction and its long span qualities.

Speed was an important issue on this project and James Killelea managed to erect the entire frame in just five weeks.

"We've done similar David Lloyd projects and this helped us," said James Killelea Project Manager Bob Allan.

As time was of the essence the fabrication of the steelwork was done while the early preparatory works were being carried out on site. The project is located on a former car park which needed to be cleared before a culvert was diverted and pad foundations installed in readiness for the steel erection.

"Once steel was on site the main frame went up quickly and on schedule, which meant we could then get the roof on and let all the follow-on trades get started," commented Mark Allen, Project Manager for main contractor Pellikaan Construction.

The Worcester centre consists of a two storey structure with an asymmetric curved roof which allows sufficient space for three internal tennis courts - two of which are on the upper level along with a 900m² fitness suite. The ground floor accommodates a 25m swimming pool, entrance bar and restaurant, a children's pool, a sauna and changing rooms.

## Academic collaboration for software provider

CSC's specialist solver development team is collaborating with a leading professor to further develop its solver, the analytical engine that sits behind its Fastrak and Orion building design software.

Bassam Izzuddin, Professor and Head of the Computational Structural Mechanics Group at Imperial College, London, is providing technical advice and consultancy to help CSC deliver a faster analysis engine.

Phase 1 of the project, which has been in progress for two years, is due for completion early this year. The new analysis engine will underpin all future releases of CSC software products, including new versions of Tedds, Solve, Fastrak and Orion.

# Diary

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

**16 Jan 2013**
**EC4 Composite Design (Part 1)**
1 hour webinar

**22 Jan 2013**
**Steel Building Design to EC3**
1 day - Bristol

**6 Feb 2013**
**Legal Implications of BIM Procurement**
Guest Speaker Jessica Taylor, Clarkslegal LLP
1 hour webinar

**7 Feb 2013**
**Portal Frames Design**
1 day - Manchester

**12 Feb 2013**
**EC4 Composite Design (Part 2)**
1 hour webinar

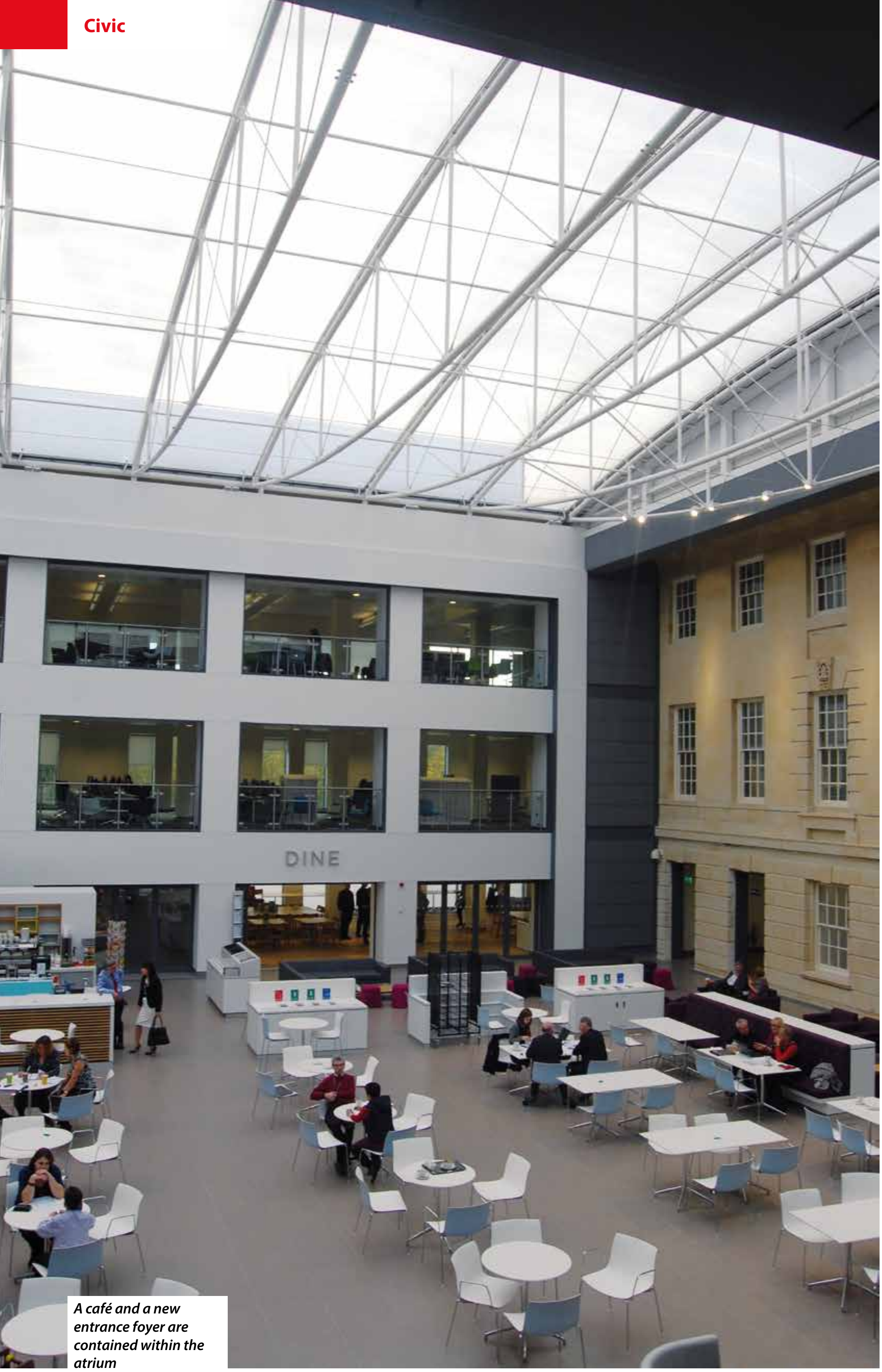
**27 Feb, 6 Mar, 13 Mar 2013**
**On-line Steel Building Design to EC3 - Part 1**
On-line course

**12 Mar 2013**
**Design of Structural Stainless Steel**
1 hour webinar

**21 Mar 2013**
**Steel Connection Design**
1 day - London

**17-18 Apr 2013**
**Essential Steelwork Design (2 day course)**
1 day - Bristol

**23 Apr 2013**
**Steel Building Design to EC3**
1 hour webinar




*A café and a new entrance foyer are contained within the atrium*

# Trusses create new indoor space

The centrepiece of the refurbishment of Wiltshire County Hall in Trowbridge is a multi functional atrium formed by roofing over a previously open courtyard.

Steel construction has played a major role in the modernisation and expansion of Wiltshire County Hall, a project that will help the County Council transform the way it delivers its services.

A £24M revamp will result in a larger more transparent and user friendly building, enabling the council to consolidate many services which are currently spread around the county town.

Being delivered in two phases by Kier Western, phase one of the project was officially opened in early November 2012. The major part of this phase involved enclosing a previously open courtyard situated between the County Hall's two existing office blocks.

As well as providing a larger internal link between the council's original 1930s Hall and its 1970s built extension, the work has also created a large covered zone that now houses a new entrance, reception and waiting area, and an indoor café.

"The idea was to change the perception of the County Hall by opening it up to the public," explains David Miles, Stride Treglown Project Architect. "By creating the atrium with a café and new waiting area, the Hall is now more accessible and inclusive for the general public.

"Previously it wasn't obvious where the main entrance was, but now it is and people have more reasons for entering the Hall."

The local library is one of those reasons, as it has been relocated from other premises to the ground floor of the revamped 1970s built extension. Adjoining the new atrium, the library opens out into the new indoor space and forms part of this major refurbishment programme.

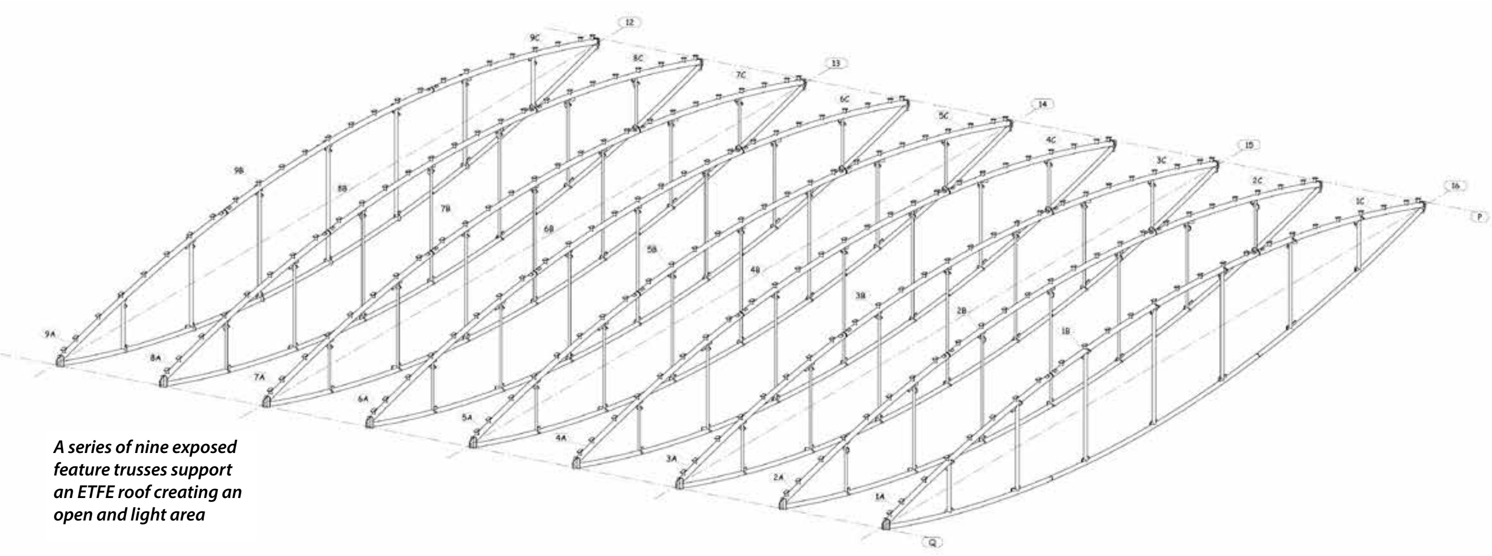
However, the most prominent eye catching part of the project, as well as the most visible, is the steelwork forming the atrium, or covered courtyard.

A series of nine 28m long tubular trusses, supporting a lightweight ETFE roof, create the bright and welcoming indoor space. Tubecon, a division of Billington Structures, fabricated, supplied and erected the trusses, while specialist subcontractors installed the ETFE to the steelwork.

Because of the length of the trusses, they could not be transported to site in one piece, so arrived in three sections.

These were then assembled and bolted into complete trusses on the ground, before being lifted into place by a mobile tower crane.

The most challenging part of the design for the steelwork was the number of interfaces which the roof trusses come into contact with. "Each of the four sides are different and the steelwork connections have to accept various constraints," explains Grant Stratton, Integral



*A series of nine exposed feature trusses support an ETFE roof creating an open and light area*

Engineering Design Project Engineer.

The trusses span from the rear of the atrium, supported by the original extension's concrete columns, to the new front entrance, where new steelwork takes on the supporting role.

Secondary steelwork links the trusses together, while brackets connect the roof structure to the eaves. Here the new roof has to connect to the masonry façade of the 1930s built Hall, while on the opposite elevation the steelwork joins to the steel frame of the 70s extension, albeit just below a mansard feature.

"Steel was the only solution for this part of the job," adds Mr Miles. "It was a quick option, other materials such as concrete would have been too heavy and would have required a longer programme.

"The slender steel trusses are also a feature element, fully exposed and open to the public's gaze. We wanted something that looks elegant and that's what we've got."

Originally the uncovered courtyard was enclosed on three sides by a steel framed extension. The front elevation, containing the main entrance, has been demolished, making way for a new three level steel framed façade and entrance.

Structurally independent – for ease of construction and to provide a movement joint in an otherwise long and unbroken structural elevation – the frame offers two levels of offices above the entrance.

The steel frame has cantilevering floorplates on the interior and exterior façades, and supports a glass tinted cladding that changes hue.

Also overlooking the new open space, the offices in the two remaining extension elevations have been renovated to create more open plan floorplates. Above the ground floor library, projecting bays overlooking the atrium have been added, formed by adding new steelwork to the existing frame.

Phase two of the project has now started and this involves the refurbishment of the main 1930s built County Hall structure.

This building consists of an inner steel framed structure, surrounded by four perimeter masonry elevations. Steel columns are being removed to create larger office spaces, while new steel is being added to form new risers and an escape stairway.

Phase two of the project is due to be completed in late 2013.

**FACT FILE**

**Wiltshire County Hall, Trowbridge**

**Client:** Wiltshire County Council

**Architect:** Stride Treglown

**Main contractor:** Kier Western

**Structural engineer:** Integral Engineering Design

**Engineer for roof structure:** David Dexter Associates

**Steelwork contractor for roof:** Tubecon

**Steel tonnage:** 95t

**Project value:** £24M


*A new steel framed entrance links two previously separate buildings*

*The speed of constructing the podium with steel has allowed work on adjacent sites to start on time*

# Steel allows access to all areas

## Six weeks have been shaved off a vital construction programme by changing a podium design from concrete to steel. Martin Cooper reports.

Pancras Square forms an important part of the huge King's Cross development that is radically changing a former rundown industrial site in central London into a new and vibrant neighbourhood.

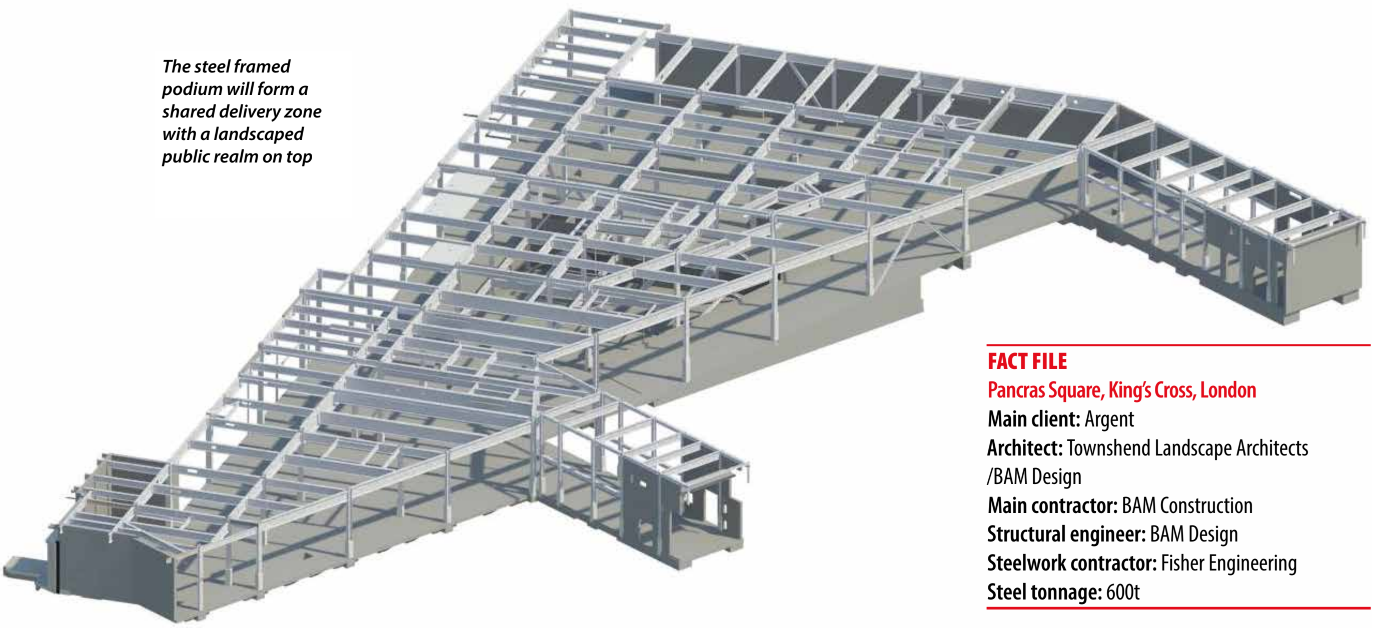
Also known as Zone B, Pancras Square will eventually consist of seven commercial and retail buildings situated around a central public square. Future tenants already include BNP Paribas Real Estate and Camden Council.

To facilitate the construction of these buildings, five of which are currently in various stages of development, a 4,000m$^2$ podium is being formed. When the project is complete this large steel structure will provide a shared delivery basement for all buildings as well as the level platform for the landscaped public realm. During the construction phase it importantly creates a robust two level (basement and level one) working surface for the project's many project teams.

"The main driver for this project is speed of construction as we had to provide construction access for the adjacent buildings, via the basement of the podium, by 23 December and via the podium top by March," explains Mick Kelly, BAM Construction Project Manager.

The podium is in fact the catalyst for the rest of the Pancras Square project and in order to achieve these important deadlines the choice of materials was crucial.

"Originally the design was for an insitu

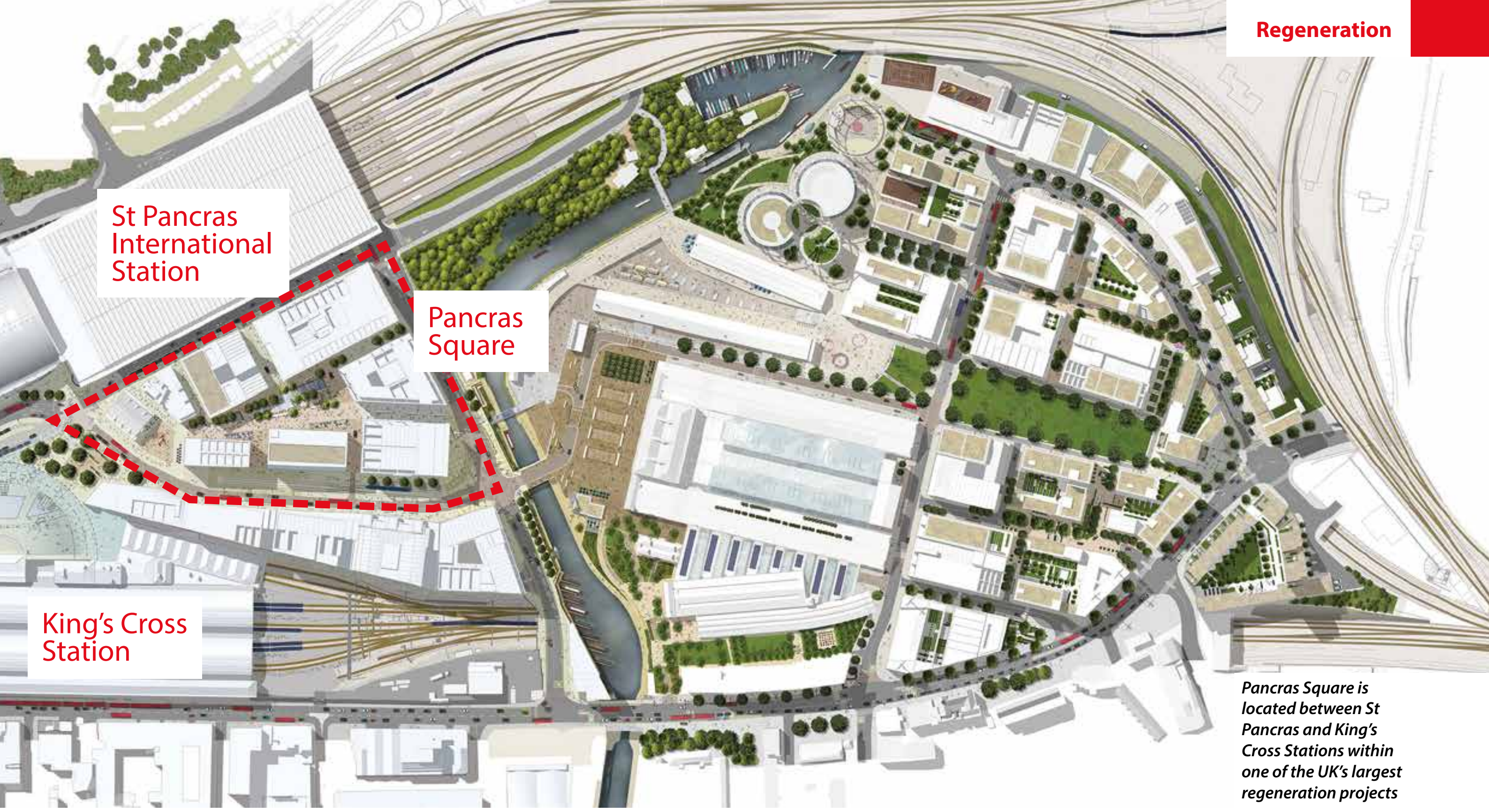


*The steel framed podium will form a shared delivery zone with a landscaped public realm on top*

**FACT FILE**

**Pancras Square, King's Cross, London**

**Main client:** Argent
**Architect:** Townshend Landscape Architects /BAM Design
**Main contractor:** BAM Construction
**Structural engineer:** BAM Design
**Steelwork contractor:** Fisher Engineering
**Steel tonnage:** 600t




*Pancras Square is located between St Pancras and King's Cross Stations within one of the UK's largest regeneration projects*

concrete structure, but it would have been too slow and the amount of formwork needed would have restricted access below the podium and to the surrounding building sites," explains David Carter, BAM Design Director.

"We changed the design to a steel frame supporting precast planks as this is the fastest method and the best way of meeting our deadlines. Uusing steel we've actually saved at least six weeks on our programme."

The Pancras Square site was previously one of Europe's largest gas works, and consequently a large amount of remediation work needed to be carried out before the construction phase could kick off during May 2012.

Once piling was complete Fisher Engineering was able to begin its steel erection sequence. The contract also included the installation of all the concrete planks, and the entire task was finished in just seven weeks.

The podium site is hemmed in on all sides by other construction projects, and with little or no room to manoeuvre the erection sequence had to be phased.

"We also had to coordinate our programme to allow vehicular access to some of these sites via our working area," explains Glen McCleery, Fisher Engineering Project Manager.

Little or no storage space was available to Fisher Engineering, so steelwork arrived on site in a just in time basis, to be erected almost immediately.

Adopting a sequential approach, Fisher Engineering gradually worked in a south to north direction along the podium length. Once the planks were installed on top of the steel, the structure was ready for the asphalt topping to be applied, which then meant the top of the podium was ready to be used.


*The podium will link into each of the surrounding commercial block's basements*

The steelwork programme was so quick and efficient that before the job was completed at one end of the site, the other end of the podium was already in use for material storage on the top deck and for vehicle access on the lower level.

To accommodate large trucks and the utilities that serve the buildings, the basement level of the podium has a 9m floor to ceiling height.

"Forming 9m high columns in concrete would have filled the site up with formwork and would have hindered the follow on trades and the necessary speed of construction," says Mr Kelly.

As the lower subterranean level of the podium will ultimately be used as a delivery yard for the surrounding buildings, it has to have large open column free spaces big enough for trucks to turn around in. These areas will also initially have to accommodate large construction vehicles from the adjacent sites.

"There are some long spans, up to 18m in places, and steel beams were the best way of forming these," says Mr Carter.

The 18m long members are huge fabricated plate girders, up to 1,500mm deep. They not only form the necessary basement spaces, but they will also have to support some heavy loads on the podium's top level. This will consist of construction traffic, the loads associated with the building of the realm and finally the public square itself.

The northern end of the site is approximately 3.5m higher than the southern end. The steel braced frame incorporates this slope via a series of steps which are located along the structure.

At the step locations BAM designed (and Fisher Engineering fabricated) a series of

*"We changed the design to a steel frame supporting precast planks as this is the fastest method and the best way of meeting our deadlines. Using steel we've actually saved at least six weeks on our programme."*

*A steel frame supporting precast planks was the quickest construction option*

plate girders and deep beams with a double lip configuration. The large steel elements accept 200mm deep planks on one side at a midpoint stiffened shelf plate, while on the other face the planks sit on the the top flange, thereby creating the step.

Greenery in the future public realm will include a number of trees and large shrubs. To accommodate the trees large prefabricated pits have been installed within the podium's upper slab. These were formed in a similar fashion to the steps. However, shelf plates and top flange angles were only required where the step was greater than 200mm. Otherwise, where the step was 200mm the planks were supported onto the previous slab and then rested on the top flange of the steelwork that was higher.

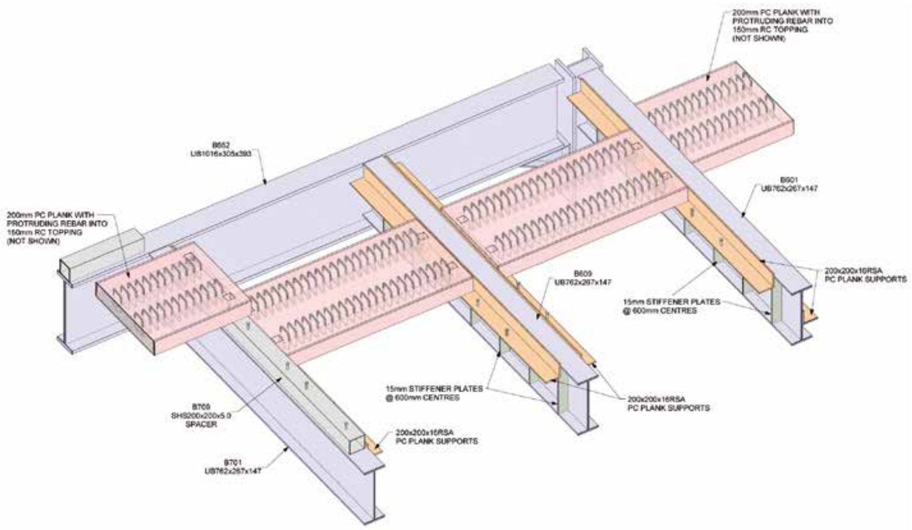
"Many of the girders are very deep and so the pits didn't need to be hung from the steelwork, they are supported by stiffened plates welded to the middle of the beams and angles welded to the bottom flange," says Mr McCleery.

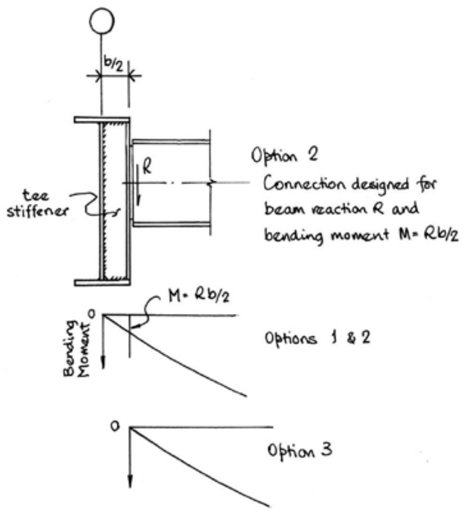
Steelwork erection and the installation of the precast planks were completed last October, which helped BAM meet its first deadline in December. The project team is now on schedule to meet the March date, when 40% of the upper level will be handed over to another contractor that will use it to enable construction of an adjacent building. They have use of the podium for 15 months, after which it is handed back to BAM to be landscaped, with the rest of the podium, creating Pancras Square, which is scheduled for completion in late 2014.

King's Cross is being developed by the King's Cross Central Limited Partnership, which brings together Argent King's Cross Limited Partnership, London and Continental Railways Limited and DHL Supply Chain.

# Connections for heavily loaded grids

Dr Richard Henderson (SCI)




In circumstances where particularly heavy loads are to be supported and speed of construction is an essential project requirement, steel plate girders are an obvious solution. The podium of the Pancras Square project has been designed for such loads which include the following: 200mm thick precast concrete planks and 1500mm of insitu concrete topping and full HA loading. The design also includes 25 tree pits.

The plate girders span 18m and are 1500mm deep with 50mm thick flanges. The webs are designed as unstiffened. Secondary beams frame into the plate girders and these have been detailed for speed of erection. At the connection points, the plate girders have been provided with a tee stiffener which projects to the toe of the flanges. This allows the secondary beam to be dropped into place between the primary beams without having to negotiate their flanges to make a web connection.

The connection at the end of the secondary beam is designed for a shear force equal to the design reaction and a bending moment prescribed by the design reaction acting at the face of the tee. The tee stiffener is welded to the web and flanges of the plate girder to transfer the reaction to the plate girder web.

In general, when connecting primary and secondary beams, three options can be considered.

Option 1: The secondary beams can be assumed to span from grid to grid and be provided with notched ends (if the primary and secondary beam flanges are at the same level) and a flexible connection to the primary beam web. The bolted connections can then be designed for shear only.

Option 2: (as described above), the bolted connection can be moved to the edge of the flange and the connection designed for shear and a prescribed moment (see illustration).

Option 3: The span of the secondary beams can be assumed to start from the edge of the primary beam flanges and the beam provided with flexible end connections designed for shear only. The reaction force must then be transferred to the primary beam web as in Option 2 and the resulting bending moment (torsion about the axis of the primary beam) suitably dealt with. This could be achieved by arranging for the moment to be transferred into a concrete slab supported by the primary and secondary beams. Option 3 requires agreement between the steelwork detailer and the designer of the structure that suitable means have been included in the design to deal with the torsion.

*Because of the roof's shape each connection and tubular column is unique*

# Station to station

## Mansfield's new bus station, which links into the adjacent railway station, features an array of bespoke feature steel columns and connections.

The former Nottinghamshire mining town of Mansfield has some big regeneration plans in the offing. An integral part of the overall plan is the construction of a new bus station, a facility which will have a footbridge link to the adjacent railway station, thereby forming a public transport interchange.

The steel framed bus station is one of the new breed of transport facilities, a million miles away in design terms from the bus garages of the past. Little or no architectural merit could be attached to many of these old structures, which were generally just large sheds, but today this is far from the case.

A good example is Mansfield's new bus station, which is a light and airy terminal, featuring open column free spaces, floor to ceiling glazed façades, architectural steel columns and an eye catching feature curving floating roof.

"We wanted an airport style, quality structure," explains Paul Horn, Nottinghamshire County Council Lead Officer on the scheme. "The design of the bus station is also open, secure and comfortable, to encourage people to use it."

With a clear set of ideas in place the Council needed to choose which materials to use for the structure. A number of options were looked at, including timber for the columns, but steel won the day primarily on a cost basis.

A series of columns are located around the perimeter of the 'Pringle' shaped structure to support the roof. The columns vary in height (the tallest is 8m) as the roof curves and slopes in three directions.

On top of each column there are six tubular branches and these are connected to the feature roof. Again, to take into account the changing geometry of the roof, each one of the 250 branches is completely bespoke.

"Each column's cap plate is individual because of the unique lug positioning for the branches," explains Adrian Downing, Caunton Engineering Project Manager. "The branches are set at different angles and have varying lengths."

"The columns have been designed to resemble nearby Sherwood Forest, that's why we initially looked at timber," explains Peter Johnson Marshall, Nottinghamshire County Council Project Architect, who designed the scheme before retiring. "Steel is very adaptable and was more readily available. The project has a timber design which has been easily adapted for steel."

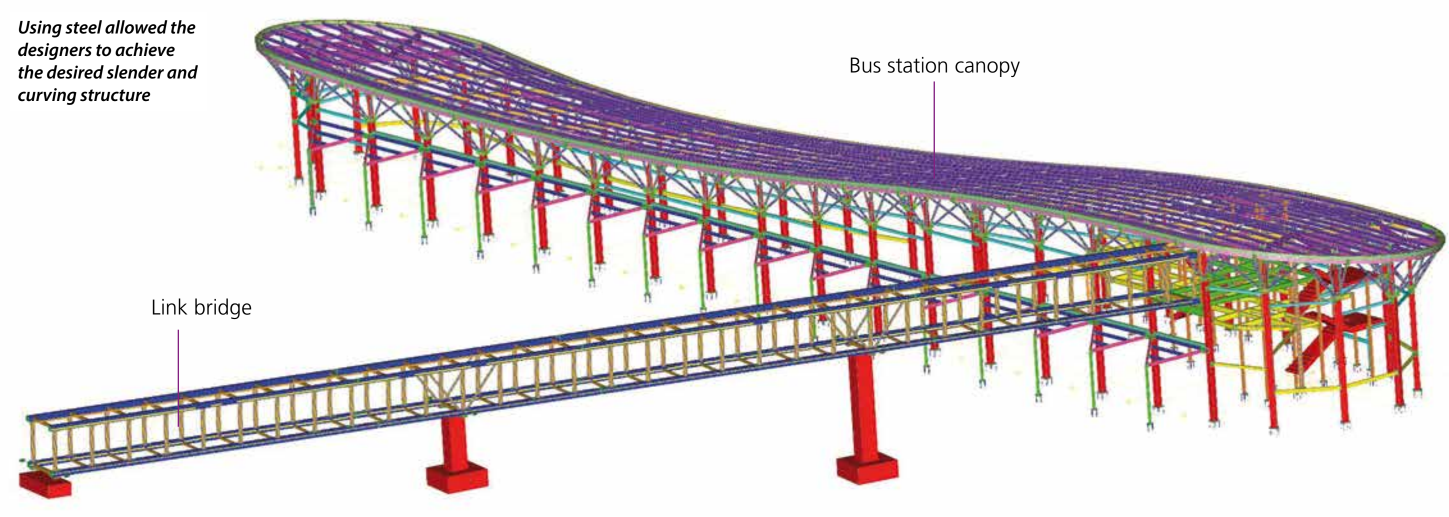
Erecting the tree columns was a time consuming exercise. Each rafter had to be temporarily propped, while each branch was attached to the upright member and the roof structure above.

Only when a phased grid of columns and rafters were up and stability achieved, could the props be taken down and then reused later in the erection sequence.

The columns are one of the main feature elements and below the branch connection they are clad in locally sourced peak district stone. "Steel and the high quality stonework work well together to create a stunning station," adds Mr Horn.

The branches themselves are left exposed, and consequently eye catching and aesthetic stainless steel pin connections have been used on either end of the branch members.

*Using steel allowed the designers to achieve the desired slender and curving structure*




Once the main bus station structure was erected Caunton was then able to bring the link footbridge to site for its overnight lifting procedure (see box story)

The bridge has been designed by Nottinghamshire County Council highway structural engineers and fabricated as a large Vierendeel box girder, 3m high and 3m wide with an overall length of 73m.

The box girder was fabricated in four sections consisting of CHS verticals with square hollow sections forming the roof and floor. The bridge sections were painted and had metal decking installed prior to going to site, all of which speeded up the construction sequence, as less work was required after the lifting had been completed.

The bridge is connected to and supported by the bus station's steelwork at one end and an abutment adjoining the railway station platform at the other, while two piers provide support along its length.

"Although the shape of the building is primarily dictated by the site," sums up Mr Marshall. "The curving roof was designed to accommodate the need for a higher elevation on one side for the bus stands, and a sloping end façade to accommodate the footbridge link."

The bus station is due to open this spring.

*The column trees are exposed and have stainless steel pin connections*

**FACT FILE**
**Mansfield bus station**
**Main client:** Nottinghamshire County Council
**Architect:** Nottinghamshire County Council
**Main contractor:** Kier Construction
**Structural engineer:** Nottinghamshire County Council/ William Saunders Partnership
**Steelwork contractor:** Caunton Engineering
**Steel tonnage:** 220t

*The footbridge connects directly to the railway station*

# Lifting a link into place

The 73m long steel footbridge links Mansfield bus station directly to the railway station. Installing this important part of the project was one of the most challenging aspects of the entire job.

Because of the bridge's length it was delivered to site in four sections. These were then assembled and bolted into two larger 30t sections, in readiness for the lifting operation.

The close proximity of the link bridge to the existing railway line and a viaduct meant the operation had to be carried out at night under a Network Rail possession.

The site team assembled at 10pm and, after an induction and briefing, began setting up the 350t mobile crane that would be used to lift the two halves of the bridge into place. Lifting began just after 1am and after some initial repositioning of lifting gear, the first section of the bridge was craned into position without any problems.

"Due to its position between the first section of bridge and the new bus station, both now being fixed points, lifting the second half into place was always going to be the most challenging aspect of the operation - the team had to get it right first time. But the meticulous preparation and expertise of the team paid dividends and the second piece was lifted into place with perfect precision," says Paul Williamson, Kier Project Manager.

The completed Block A

# Passing the speed examination

## Steel's ability to aid a quick construction programme was the reason it was chosen as the framing material for a student accommodation project in Manchester.

Fast track construction was the all important criteria for the delivery of the first batch of student accommodation at the Ducie Court development in Manchester.

Designed by architects Hodder & Partners, the project will eventually consist of 614 single and double units accommodated within three blocks.

Split into two phases, phase one of the project saw the completion of Block A last year, a structure containing 246 bedroom units. The remainder of the development, Blocks B and C, are due to be finished in time for the coming autumn term.

The construction of student accommodation is extremely programme sensitive, and if the first phase was not completed in time for the new term it may as well have been postponed until later in the year. This obviously was not an option so with only nine months to complete the job, steel was the obvious choice.

"We had looked at timber, but as parts of the blocks are eight storeys high a steel frame was the best option," explains Stephen Hodder whose practice designed the scheme. "And of course the time schedule was extremely important and a steel frame was the quickest option."

"Speed of construction was the main driver for choosing steel for this project as the first block needed to be ready for the last year's autumn term," adds Peter Ward, Partner at structural engineers Fairhurst. "Steel also gave us a lot of flexibility, as many of the room layouts had not been fixed at the design stage."

Impressively, Block A was designed and then on site within three months and this was made possible because the architect and engineer worked simultaneously to meet the client's tight deadline. "Another benefit of using steel," adds Mr Ward.

Steelwork contractor B D Structures was then issued with a concise set of engineering drawings of the steel frame.

"A lead time of just six weeks is very quick for this size of project, but the engineer provided good information and that helped us detail the steelwork and design the connections quickly," explains Chris Heys, B D Structures Managing Director.

Structurally Block A consists of 395t of steel. It is a braced frame with metal deck flooring based around a fairly regular grid pattern. Diagonal bracing is located in lift shafts, stairwells and gable walls, basically anywhere with no windows.

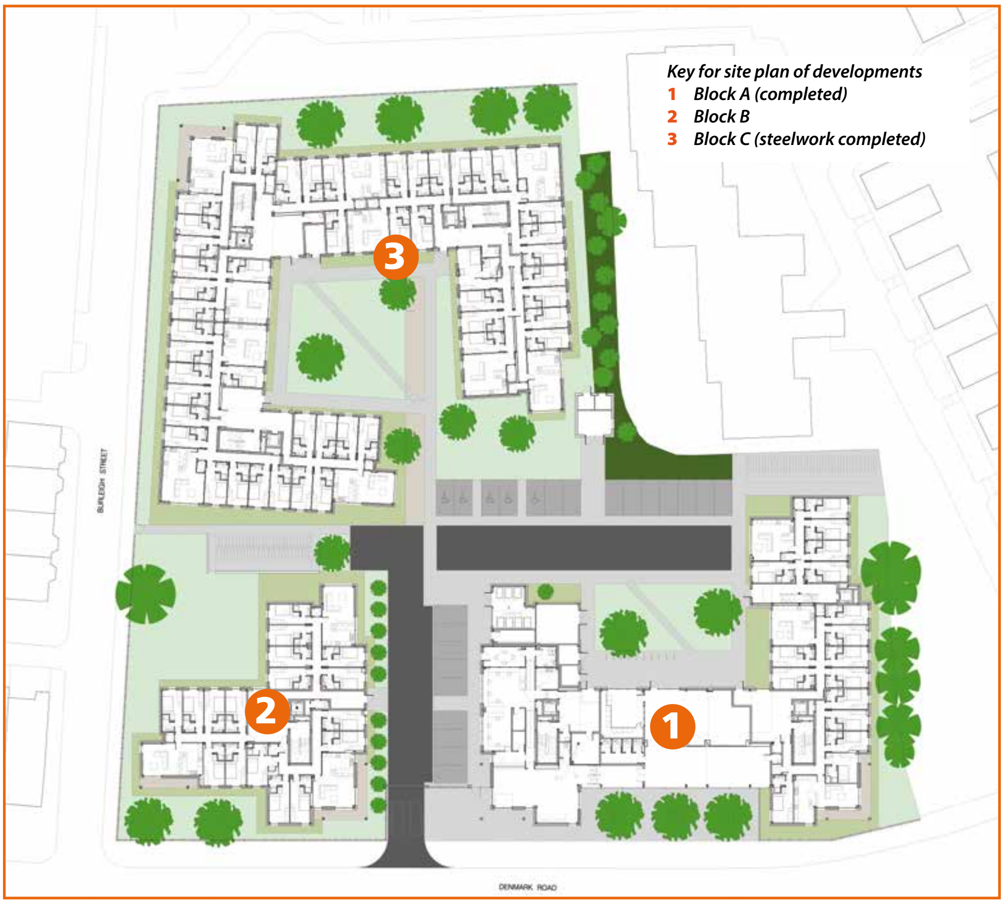
One of the most challenging aspects for B D Structures was reconciling the different tolerances of the steel frame and the structure's distinctive brick cladding.

Block A is U-shaped in plan and rises to a maximum of eight storeys high. Hodder & Partners were keen that the project should not give a monolithic definition to the adjacent Denmark Road. So the structure has lower five and six storey areas of bedrooms separated by three eight-storey towers that contain the cores.

"The lower parts of the block correspond to the traditional buildings further along the street, while the towers break up mass when one is looking at the structure," adds Mr Hodder.

The bedrooms are arranged in clusters of four and six around communal living, dining and kitchen areas. In order to reduce

*Steel erection was recently finished on Block C*




**FACT FILE**
**Ducie Court, Manchester**
**Main client and developer:** Worthington Properties
**Architect:** Hodder & Partners
**Main contractor:** Marcus Worthington Construction
**Structural engineer:** Fairhurst
**Steelwork contractor:** B D Structures
**Steel tonnage:** 925t

the amount of circulation areas, all of the clusters are based around one staircase.

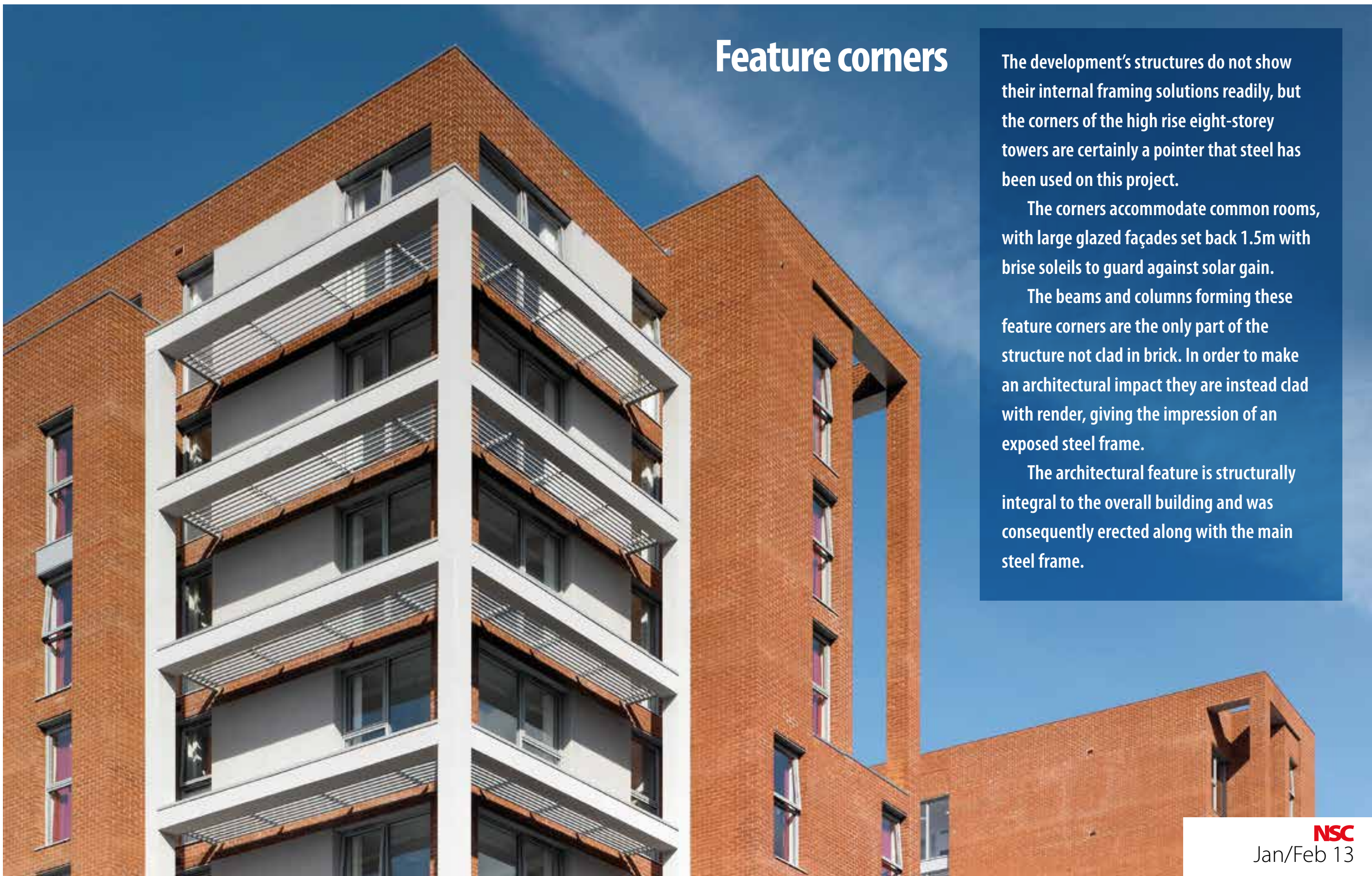
Wherever possible these clusters have been placed in a stacked formation, but this has not been possible throughout the project and so the grid does have to occasionally alter.

Further clusters, containing solely double study bedrooms and independent studios are contained in four, two and three storey 'pods' which sit lightly over the blocks below.

Phase two is up and running and B D Structures has recently completed the erection of Block C (350t), with the final piece of the project, Block B (180t), due to be erected during January.

"The lead in time for the second phase has been a little more generous, but speed of delivery has been vital again," says Mr Heys.

The phase two buildings of the development are similar to Block A, using the same detailing and design philosophy. The only difference between the structures is the internal layout of clusters, as these change according to how many single or double units are required.



## Feature corners

The development's structures do not show their internal framing solutions readily, but the corners of the high rise eight-storey towers are certainly a pointer that steel has been used on this project.

The corners accommodate common rooms, with large glazed façades set back 1.5m with brise soleils to guard against solar gain.

The beams and columns forming these feature corners are the only part of the structure not clad in brick. In order to make an architectural impact they are instead clad with render, giving the impression of an exposed steel frame.

The architectural feature is structurally integral to the overall building and was consequently erected along with the main steel frame.

# New information resource

The recently launched steel sector website – *www.steelconstruction.info* - contains six home page headings, one of which, Sectors, is explained here.

Click on Sectors and eight options are available:

## Multi-storey office buildings

Steel dominates this sector as the majority of the UK's high rise office blocks are constructed with a steel frame. Cost, value for money, flexibility, sustainability and speed of construction are important criteria project teams have to consider when choosing a framing material. In this section of the website there are articles explaining why steel comes out on top for these issues and consequently is the material of choice for this sector.

A number of case studies of high profile and prominent buildings, are here, including video case studies of the Walbrook Building, London and the Co-operative HQ in Manchester, two projects that achieved client aspirations by using steel.

## Single storey industrial buildings

Single storey buildings are by far the largest sector of the UK structural steelwork market, representing nearly two thirds of total activity. These structures have a wide variety of uses and on this page of the website the different forms of steel construction utilised for this sector – portal frames, lattice structures and suspended structures – are all explored. Highlighting the profusion of uses single storey industrial buildings have, case studies include a paper mill, a recycling plant, a manufacturing facility and distribution centres.

## Education buildings

A variety of types of steel construction are needed for the educational sector, that are able to achieve strict performance targets, such as acoustic, thermal or ventilation requirements and at the same time provide flexible spaces to suit a variety of uses. There is also a need to consider how the buildings can be adapted and reconfigured to meet future educational needs.

Steel construction is able to address all these aspects and is routinely used to deliver cost-effective and sustainable educational buildings. Offsite manufacture improves safety and construction speed, reduces waste and disturbance, and results in better quality.

## Leisure buildings

Leisure buildings include stadiums, sports arenas, swimming pools and theatres, all of which are suited to steel construction. These structures vary in size but all share the need for long span column free spaces. This can easily be achieved with steelwork and in this section all forms of suitable construction are explained, from continuous frames, portal frames and braced frames to long span options with trusses, cellular beams and curved beams. Case studies include the London 2012 Olympic Stadium, the Amex Stadium in Brighton and the Young Vic Theatre.

Launched last October the *www.steelconstruction.info* website brings together all the technical and cost information designers need on steel construction.

This free encyclopaedia for the steel sector has been specifically designed to be as comprehensive as possible, while at the same time being user friendly.

In response to comments from architects, all 100 plus articles on the website have been edited to improve their appearance, while the home page has been redesigned adding colour and images, which should go live later this month (January).

Other recently added enhancements include a raft of new articles, video case studies and a new link to steel section sizes, while a video function to play through a YouTube channel is currently under construction.

The home page of the website has six main topics (Sectors, Key Resources, Topics, Hot Topics, CPD Events and Training, and Quick Links) which the user can choose from. These six topics then have a vast number of internal links on all relevant steel information. In the forthcoming issues of New Steel Construction we will have articles on each of the six topics, beginning in this issue with Sectors.

Since the launch the site has evolved and will continue to be updated. You can follow the updates at:

**@steelcoinfo**
**steelconstruction.info**
**steelconstruction.info**

## Retail buildings

The retail sector is very competitive and therefore the ability of steel construction to deliver flexible, lightweight solutions fast and cost effectively make it the material of choice. Aspects of construction highlighted within this section consist of portal frames, trusses, braced frames, composite construction, long span beams, building envelopes and floor systems. Many of these construction techniques will arise on the same project and to highlight this, featured case studies include some large-scale shopping centres in England, Wales and the Republic of Ireland.

## Healthcare buildings

A number of specific criteria will always apply to the healthcare sector and steel construction can satisfy them all. Attributes of steel construction explained in this section include speed of construction, flexibility and adaptability, quality, minimised disruption, cleanliness, vibration and acoustic performance, service integration, thermal insulation of cladding, and environmental benefits.

## Residential and mixed use buildings

The use of steel in the housing and residential building sector has grown over the last 10 years primarily because of the growing appreciation of the performance benefits that arise from off site construction, which is particularly important in urban or mixed-use buildings. Key issues, highlighted in this section, for the design of residential buildings include procurement, economics, programme, sustainability and service integration. Case studies include student accommodation at Ducie Court in Manchester, residential apartments adjoining a commercial development in central London (Park House), and student accommodation constructed atop a large shopping centre at Trinity Square in Gateshead.

## Bridges

Steel is widely used around the world for the construction of bridges from the very large to the very small. These encompass a variety of types and forms of construction including: beam bridges, box girder bridges, truss bridges, arch bridges, cable stayed bridges and suspension bridges, all of which are highlighted and explained in this section. Landmark steel bridges embody a number of design attributes, which are emphasised in eight case studies including Derry/Londonderry's Peace Bridge, the Clyde Arch Bridge in Glasgow and the Borough High Street Bridge in London.

*At 177m tall the structure will be one of the City of London's highest buildings*

**FACT FILE**
**20 Fenchurch Street, London**
**Developers:** Land Securities, Canary Wharf Group
**Architect:** Rafael Viñoly Architects
**Construction Manager:** Canary Wharf Contractors (subsidiary of Canary Wharf Group)
**Structural engineer:** Halcrow Yolles
**Steelwork contractor:** William Hare
**Steel tonnage:** 8,216t

# Steel rises to the challenge

Featuring a unique and iconic shape, the construction of 20 Fenchurch Street has required the project team to come up with a number of innovative solutions. Martin Cooper reports.

*A rooftop Sky Garden will provide a catering and events space for tenants*

There is a new landmark structure rapidly taking shape in the City of London. 20 Fenchurch Street (dubbed the Walkie Talkie) will enhance a skyline that has altered continuously over the years, as this 38 storey tower has an iconic and unique structural shape.

From a relatively narrow base the building gradually flares outwards providing larger floor plates on the upper levels. Each floor has a unique size and the final office level 34 achieves an impressive increase in floorspace of up to 60%. Topping off the structure is a fully enclosed sky garden that will include catering facilities as well as 360 degree views over the capital.

Designing the structure of this iconic building was a major challenge as each floor has a unique structural layout. An extensive modelling procedure needed to be undertaken with the project's architect Rafael Viñoly and structural engineer Halcrow Yolles developing a master geometry 3D model. This made it possible to develop in precise detail the final configuration and setting out of the exterior wall, as well as the final column positions and framing solution.

The model was further developed collaboratively with the whole design team to establish a comprehensive BIM model that was used by the project team and subcontractors. Interestingly, Canary Wharf Contractors took the modelling a stage further and enhanced the model into a 4D version, with the added dimension being time (see story over page: 4D vision).

"By taking this approach we were basically asking the industry to do something different," says Charlie Paul, Canary Wharf Contractors Associate Director. "Adding the time dimension meant we were able to work out and predict the entire construction sequence, so much so that during the tender stages we already knew what the steel programme would entail."

The choice of steelwork as the framing material was made for a number of reasons, not least for its speed of erection. William Hare completed the entire steel package in December in just 35 weeks. Using any other material for this architecturally shaped building would not have been this speedy.

To erect the steelwork William Hare used three tower cranes positioned on top of the core. Canary Wharf Contractors provides these cranes, a working policy it always adopts. "This works well as we manage the schedule and allocate times between trades for crane usage," explains Charlie Paul, Canary Wharf Director.

By the time the core was completed and the cranes were being readied for installation, Canary Wharf had worked out the optimum position for each tower crane. With the aid of the 4D model, a location was primed whereby each crane could supply a third of the project. In order to achieve these positions, one crane had to be cantilevered off of the core.

Design wise, the main challenges were how to structurally balance a building of such an unusual shape, while accommodating the unique floors plates without increasing the structural depth. This final point was crucial, as any change in floor heights would render the building's double-stack lifts inoperable.

Balancing the structure was done by moving the core from its original location

*To balance the structure the main core was moved slightly off centre during the design model stage*


The majority of the steelwork was erected by tower cranes

in the middle of the floor plates to a position that corresponded to the centre of the overall mass. In other words, it is now located slightly off centre on any given floor plate but remains centred on the whole.

A structural engineering trick was needed to accommodate the geometry of the changing floor plates. "The building's internal spans change from 11m up to 21m, but the constant structural depth only works up to an 18m span," says Jonathan Hendricks, Halcrow Yolles Senior Principal.

The solution was to install the columns up to level 22 at an outwards incline matching the façade. From here up, the north and south elevation columns change direction and pull away from the façade.

"We then have a 3m cantilevering effect combined with an 18m internal span, which on the topmost office level gives us the desired 21m span," explains Mr Hendricks. "Steel was instrumental in unlocking this ability to frame a growing span without increasing the depth of the floor."

In terms of magnitude, the corner columns actually travel 12m in the north south direction and 6m in the east west direction, as one moves up the building. This forms the unique flaring shape of the structure.

To create this shape the steelwork is faceted to approximate the curvature of the façade. Generally the faceting of the columns occurs every four storeys and so provides the optimum balance of minimising the complexity of the steel while adhering to the architectural intent. However, in areas of high curvature, such as near the top on the east and west elevations, columns have been faceted every two storeys.

The core provides the steel frame with its overall stability, however further up the building this changes. For the sky garden roof, which begins at level 35, the stability

*From a relatively narrow base the building gradually flares outwards providing larger floor plates on the upper levels.*

## Steely Success

**All of the steelwork fabrication for the project is being undertaken at William Hare's factories in Bury, Scarborough and Wetherby. Including rebar the overall steel content of the building is more than 13,000t, but the frame itself is made up of 8,216t of steel, which equates to some 4,500 separate sections.**

**The largest steel members to be lifted into place were also the longest beams at 15m and weighing 9t each. A large number of the main floor beams are cellular members, used for their efficiency and service openings.**

**To erect the outer cranked columns, William Hare utilised a bespoke spigot that was welded to the top of each column. Suggested by Canary Wharf Contractors and designed by William Hare, it allowed the column above to be placed at the correct angle.**

**"Because of the angle of the crank these connections meet at three axes and are not straight," says Adam Mosey, William Hare Project Manager. "The spigot actually defines the position and angle for the column above."**

**The spigots - which helped speed the erection process - were welded to the columns during the fabrication process.**

**Another factor for the steel programme's speedy success was the fact that the concrete core was planned for completion early in the construction programme, thereby allowing William Hare to do a thorough survey of the embedment plates which it used to connect the steel beams to.**

*Many of the columns are faceted every two floors to create the building's shape*

is provided by structural fins, which span 55m from east to west over the open plan area. Forming a large portal frame, the 1,200mm deep box sections also support the glazing.

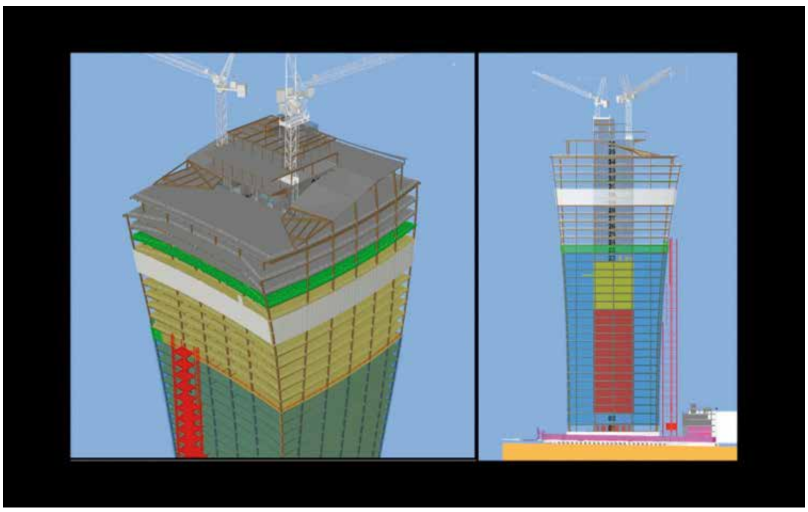
The original design intent for the sky garden roof was that the aluminium fins, which run up the east and west elevations, would continue horizontally over the roof with an internal space frame to support the glazing.

Instead of a space frame, Canary Wharf Contractors deemed it far more practical to turn the fins into architectural structural steel portal frames with the same profile as the original fins. The new solution was economical, time saving and more sustainable.

Summing up Mr Paul says: "We worked this out via our advanced model which has been a very important tool in developing a safe system of manufacturing and erecting these huge portal frames."

20 Fenchurch Street is due to be complete by March 2014.

*Public thoroughfares have had to be kept open around the constrained project site*



## 4D vision

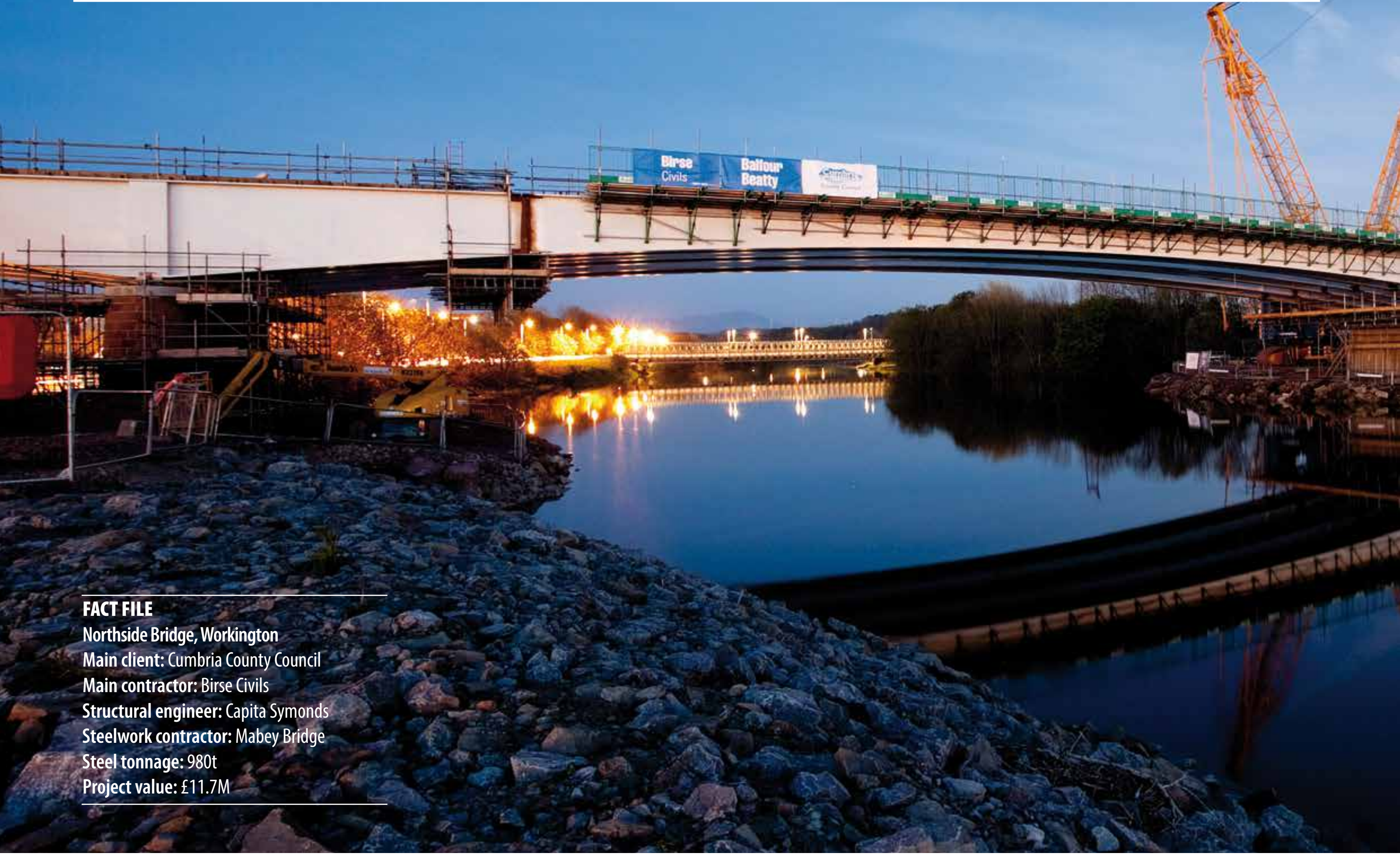
Managing a prestigious scheme with a 4D model may be the first time it has taken place in the UK. Canary Wharf says that the model has allowed it to micro manage the job throughout and to continuously inform the project's design team and specialist contractors to make sure they were happy with the plan and everyone was on board to achieve what Charlie Paul, Canary Wharf Contractors Associate Director, calls "a sporty programme."

The 3D model helped with the clash analysis, but the 4D version enabled the team to have an accurate timeline of interfaces. By studying historical weather patterns the model even predicted the entire job right up to completion - including the steel erection, the installation of the cladding and the fit out.

The model was used to work out how the early installation of the main lifts would enable the job to proceed more efficiently. As soon as the main core was slipformed, the lifts were installed and immediately used to transport personnel and materials up and down the project. Working in conjunction with the project's hoists, they helped to speed the programme up.

# Restoring a vital link

Three years after its calamitous collapse Workington's Northside Bridge has reopened with steelwork playing a pivotal role in the re-spanning of the River Derwent.




**FACT FILE**
**Northside Bridge, Workington**
**Main client:** Cumbria County Council
**Main contractor:** Birse Civils
**Structural engineer:** Capita Symonds
**Steelwork contractor:** Mabey Bridge
**Steel tonnage:** 980t
**Project value:** £11.7M

The original Northside Bridge collapsed during the devastating floods of 2009. The effects of this deluge were immense and, as far as infrastructure is concerned, this part of Cumbria has now fully restored its main links with the reopening of this vital bridge that carries the A596 across the River Derwent.

The new 152m long three span composite steel bridge has been erected in the same position as the former structure. It is supported on concrete piers with bored pile foundations and clad in sandstone, some of which was recovered from the original bridge.

"Steel offered us a number of benefits, one of which was speed of construction," says Alan Webb, Capita Symonds Project Manager.

Main contractor Birse Civils started on site during August 2011 and completed the programme in a little over 14 months, achieving one of the client's main objectives – namely having the new bridge open within three years of the original structure's demise.

Early works for Birse included the removal of the original bridge's foundations and locating the service diversions. For the foundations a total of 72 bored piles were installed to a depth of 26m.

The structure's two piers are positioned on both riverbanks, this design negated a lot of potentially hazardous working over and in water and resulted in a quicker construction programme.

But it was not the only reason for this design as Jason Dixey, Project Manager for Cumbria County Council, explains: "During public consultations about the construction of the bridge, local people made it clear they wanted something that looked robust and bearing in mind what happened to the old bridge, piers in the river did not seem appealing."

Mabey Bridge fabricated, supplied and erected the steelwork package in three phases.

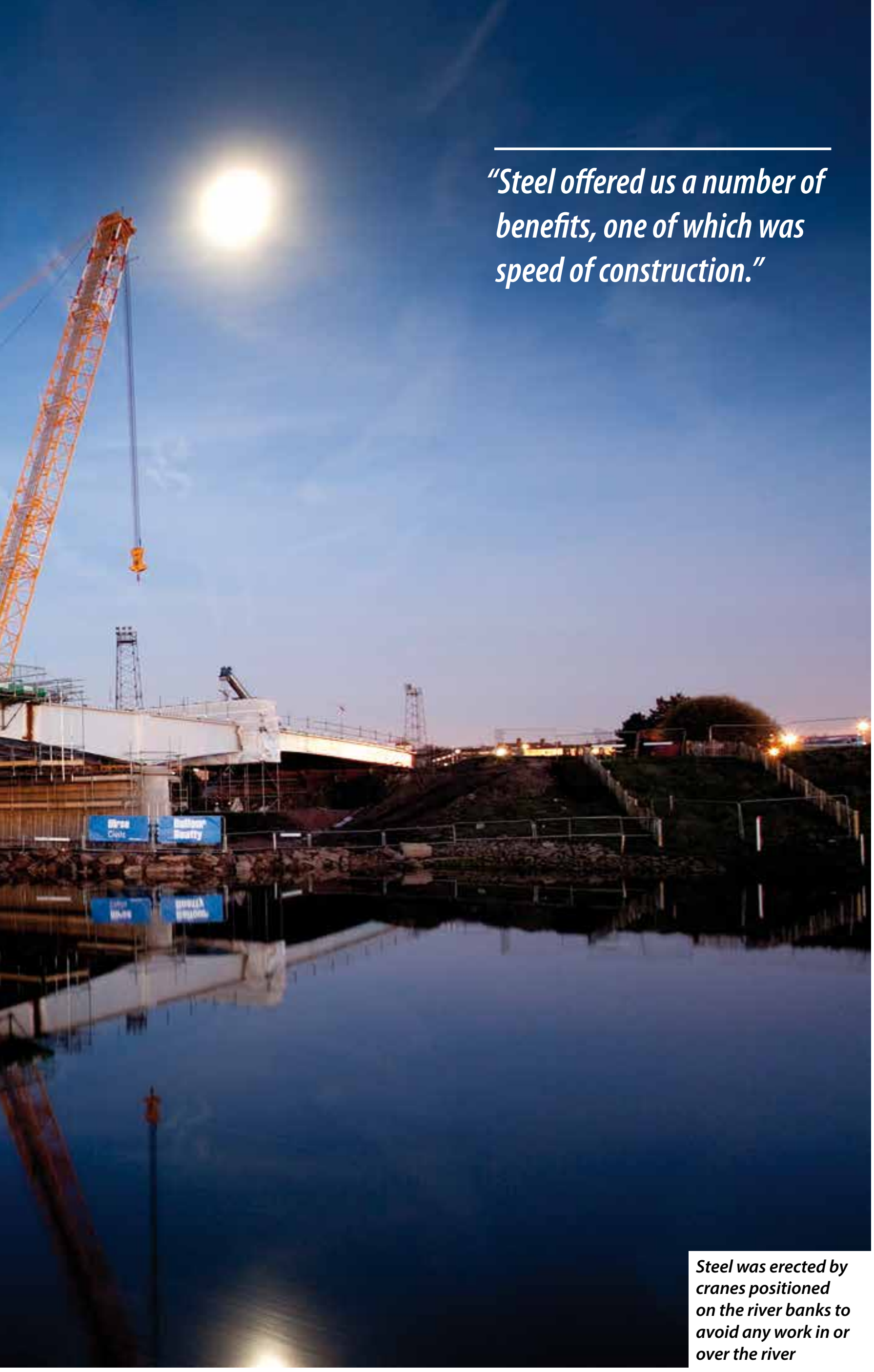
Splitting the structure into three segments, the northern side of the bridge was erected during one weekend in February, followed a month later by the installation of the southern part.

The northern side of the bridge was comprised of six pairs of braced girders, three 30m long pairs and three 23m long pairs all incorporating the bridge's haunch.

Spanning from the riverbank abutment, onto a pier and then over the river, temporary trestles supported the structure between the pier and the abutments during the erection process.

"Once all of the girders were installed, and the cross beams had been welded into place the trestles were removed as the steelwork was then stable," says Phil Dilworth, Birse Civils Site Manager.

Two mobile cranes were utilised for this operation, one 700t capacity unit to do the three girder lifts, and a smaller 60t crane to install the cross beams.



*"Steel offered us a number of benefits, one of which was speed of construction."*

*Steel was erected by cranes positioned on the river banks to avoid any work in or over the river*

*The bridge was opened by HRH The Princess Royal last October*

The northern section spans the A596 and in order to install the steelwork the project team had a weekend possession in place from Friday night until Monday morning.

So successfully and quickly was the steelwork erected that the road was able to reopen on Sunday lunchtime – earlier than anticipated.

In a similar procedure the southern section, which is identical to the north, was then erected last April, leaving the middle 46m long mid span to be installed during May.

In order to avoid working in and over the river, the installation of the middle section was done slightly differently.

"We couldn't put temporary trestles in the river so we had to weld the six pairs of girders into three long sections and lift them into place with a much bigger crane," says Mr Dilworth.

Mabey Bridge brought six pairs of girders to the riverside site to make the centre 46m long infill girders, and over a period of four weeks they were welded into the required longer lengths.

The cantilevering formwork – used to form the deck – was also installed on the steelwork before the lifting process, minimising even further the amount of work that would have to be done over the river.

Birse provided an on site assembly yard adjacent to the southern abutment for this work.

Each of the three lifts needed to erect the bridge's mid span weighed 160t, 88t of steel and the remainder consisting of formwork. To do this work a Demag cc2800-1 crawler crane was needed. This unit has a lifting capacity of 700t, 60m long boom, a 180t counterweight and took two days to assemble on site.

"Installing the final sections of the bridge girders was a key moment in the delivery of the project. It was also significant in this case as it re-established the connection between the north and south banks of the River Derwent," sums up Mr Dilworth.

*The mid span section is lifted into place by a 700t capacity crane*

*The replacement bridge takes shape*

# Engineered for fire safety

The UK construction industry leads the way in fire engineering as many of the nation's tallest steel framed buildings demonstrate, writes John Dowling, BCSA Sustainability Manager.

The obligations placed on those who design and construct buildings to ensure that they are both safe and healthy are contained in the Building Regulations. The requirements of the regulations are set out in functional terms, i.e. they outline what has to be done but not how this can be achieved.

For example, Requirement B3(1) of the Building Regulations for England & Wales states: "The building shall be designed and constructed so that, in the event of a fire, its stability will be maintained for a reasonable period."

The Governments of the various regions of the UK publish documentation that provides guidance on means by which compliance with their Building Regulations can be achieved. In terms of fire, the most widely used is Approved Document B, which applies in England and Wales.

## CASE STUDY: THE SHARD

**The 310m tall Shard is a mixed use structure, which is currently the tallest building in the European Union. Much of the structure is steel framed and to ensure the efficient integration of passive fire protection, structural engineer WSP also provided fire engineering services.**

**"For a building of this size and nature, it was important to consider a range of approaches to ensure that the fire protection specified met the requirements of all stakeholders, while ensuring an added level of confidence that the structural fire performance of the building would be acceptable under the expected range of fire scenarios," says Dr Mark O'Connor, WSP Technical Director. He added: "Fire protection is enhanced on certain structural elements to ensure they never fail, whereas elements less critical to the overall stability have reduced levels of fire protection. Applying fire protection in this strategic way, particularly for a large building such as The Shard, has significant cost benefits."**

**Fire and structural engineer:** WSP
**Steelwork contractor:** Severfield-Rowen
**Main contractor:** Mace

Among the various rules for fire safety in buildings contained in this document are details of the fire resistance requirements to meet the necessity for structural stability described above. For example, an office building over 30m in height requires 120 minutes fire resistance plus a sprinkler system.

Increasing innovation in design, construction and usage of modern buildings has created a situation where it is sometimes difficult to satisfy the functional requirements of the Building Regulations by the use only of the provisions given in the Approved Document B. Recognition of this, and also increased knowledge of how real buildings react in fire and of how real fires behave, has led many authorities to acknowledge that improvements in fire safety may now be possible in many instances by adopting fire safety engineering approaches. A wide ranging programme of research and development has supported this.

Approved Document B says: "Fire safety engineering can provide an alternative approach to fire safety. It may be the only practical way to achieve a satisfactory standard of safety in some large and complex buildings and in buildings containing different uses."

Fire safety engineering can be seen as an integrated package of measures designed to achieve the maximum benefit from the available methods of preventing, controlling or limiting the consequences of fire. Many fire safety engineering studies have a structural component and the Institution of Structural Engineers says: "By adopting a performance based approach to structural fire engineering….more economic designs can be achieved and more innovative and complex buildings can be constructed."

The UK can now lay claim to be a world leader in fire safety engineering. As a consequence, the majority of tall and complex buildings now benefit from an engineered approach to fire rather than relying on the prescriptive provisions of Approved Document B or similar. This has proved beneficial to the construction industry as a whole, but particularly to the steel construction sector, which has carried out most of the research and whose structures consequently offer the greatest potential for improved solutions using analytical methods.

## CASE STUDY: HERON TOWER

**This 203m tall tower has been designed with a vierendeel stress tube structure which wraps around the perimeter of the building. The office floors are supported by long span (up to 14m) solid section beams, acting compositely with a 130mm deep concrete floor slab. The 46-storey building features three-storey floor units, known as "villages", so a severe fire would have the opportunity to spread over three floors. Most buildings are compartmentalised floor by floor so a fire risk analysis usually considers a fire spreading over only one floor at a time. "This is the first high rise building we know of in which the design has deliberately considered [the potential for] three-storey fires. The Approved Document does not cover this so we undertook research to determine how the fire would spread and which elements would require more or less fire protection," says Dr Graeme Flint, Arup Senior Fire Engineer. Offsite intumescent coating was applied to selected members and the analysis revealed that secondary steelwork did not require protection. A further analysis revealed that using the prescriptive approach to fire protection based on the recommendations of Approved Document B would have caused some internal columns to fail, so the fire protection of these elements were enhanced using 20mm thick board. The approach made significant savings to the cost of fire protection, while providing a more robust fire protection strategy. "On a similar project, using a similar approach, we saved £4M [off the cost of fire protection], while demonstrating an acceptable robustness" adds Dr Flint.**

**Fire and structural engineer:** Arup
**Steelwork contractor:** Severfield-Rowen
**Main contractor:** Skanska

# Organic waste solution framed in steel

The Greater Manchester Waste PFI scheme is the largest of its kind in Europe and steel framed buildings are crucial to the programme.

*The Bolton facility is the fourth Greater Manchester IVC unit, all of which are housed in steel framed sheds*

**FACT FILE**
**Bolton In Vessel Composting (IVC) plant**
**Main client:** Viridor Laing (Greater Manchester)
**Architect:** T D Jagger
**Principal contractor:** Costain Construction
**Structural engineer:** A L Daines & Partners
**Plant operator:** Viridor
**Technology provider:** TEG Environmental
**Contractor for building envelope:** Border Steelwork Structures
**Steel tonnage:** 220t

Worth £3.8bn, the Greater Manchester Waste scheme includes the construction of 42 recycling and resource recovery plants for household and industrial waste all located in and around the UK's third largest conurbation.

The overall programme is the largest such scheme in Europe and part of it includes the building of four In Vessel Composting (IVC) plants. These are designed by TEG Environmental, who are a specialist technology provider that designs, builds and operates IVC sites to treat organic waste.

Many local authorities are now investing in IVC plants as they offer an environmentally friendly solution for recycling food and garden household waste.

This completely natural composting process generally takes approximately two weeks to process, with a further six to eight weeks for the product to stabilise before being dispatched as soil improver.

The Bolton plant is the fourth IVC facility to be constructed by TEG as part of the Greater Manchester contract, following on from similar builds in Rochdale, Stockport and Trafford Park.

"Together the plants will recycle 179,000t of organic waste per annum, Bolton IVC will deliver 50,000t of this total," says Nichola Rafferty, Contract Manager for TEG on the Greater Manchester project.

All of the IVC facilities are housed within steel framed structures and Border Steelwork Structures has erected three of these projects on behalf of TEG.

"Cost, efficiency and the need for large clear spans were the main reasons why the IVC plants are all steel framed structures," explains Thomas Jagger, Director of project architect T D Jagger.

For the Bolton plant, Border has erected 340t of structural steelwork as part of its overall contract as envelope provider.

"We are responsible for all internal civil works," says Stuart Airey, Senior Contracts Manager for Border Steelwork Structures. "As the steelwork contractor, supplier and erector, it has been beneficial for us to also take responsibility for the civil and building elements as well as the cladding and roofing of the plant, as all of these trades revolve around the completion of the steel frame."

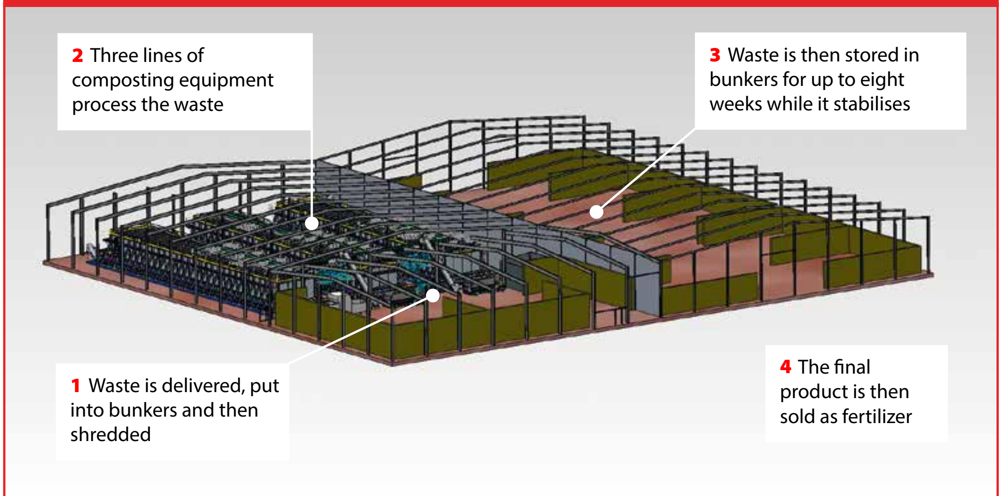
Border started on the site, located on the outskirts of Bolton, last February. Previously Costain had completed a thorough ground improvement programme as a number of mine workings beneath the site needed to be drilled and grouted.

The ground was then stabilised, vibro stone columns installed and ground beams cast.

Following the completion of the foundation works, the steel erection programme was able to start during May and this process was divided into three phases in order to complete the task as quickly as possible.

The overall footprint of the structure is 8,046m², measuring 96m x 84m. For operational purposes the building is

## The In Vessel Composting (IVC) process



*Once the steel frame is erected the large composting equipment is installed*

split into three distinct parts to comply with industry regulations, which require designated 'clean' and 'dirty' areas of operation to avoid cross contamination between the accepted material and the final end product.

The first part houses the waste intake area with bunkers and shredding equipment; the second contains the composting technology; and the third is the compost management building where compost is stored while it stabilises.

"The requirement for three distinct zones dictated the structural design of the plant," says Mr Jagger. "We had to devise a way these could all be accommodated within a structure with no strange shapes; a steel portal design was the best option."

Long clear spans are important, as the waste intake area will have numerous vehicles manoeuvring. Internal columns, which could hinder vehicle movement, were out of the question, so a clear span 30m portal frame has been erected.

Interestingly, this part of the structure has been swivelled 90 degrees from the rest of the steel frame in order to get the long clear spans.

The building is 48m wide in the opposite direction and this was deemed too long for a single span. The zone directly behind the waste intake area, which houses the composting technology, is facing in the other direction and the 48m width is accommodated with a propped portal frame. The three column bays measure 18m, 12m and 18m, and accommodate the three silo cage composting lines.

"We erected the steelwork for the area to house the composting lines first, followed by the waste intake area, to enable TEG's specialist suppliers to proceed as quickly as possible." says Mr Airey. "It was important to get the steelwork up to allow the job to progress steadily."

*"Cost, efficiency and the need for large clear spans were the main reasons why the IVC plants are all steel framed structures."*

While steelwork erection was ongoing in one phase, concrete bunkers and plinths for the silo cages were being cast simultaneously in adjacent zones. As Border was responsible for the entire package, it could organise all trades around one common roster.

Immediately after the steel frame was erected the cladding and roofing contractors followed on behind, ensuring the structure was watertight as quickly as possible.

For the steel erection programme Border used a 50t capacity mobile crane, while a mobile tower crane was utilised to install the cladding.

The building's cladding consists of a traditional composite panel with a 200 micron thick external paint coating, which is applied internally as well as externally to protect it from the humid composting environment

Construction of the Bolton IVC is due for completion in March 2013 and the plant will start receiving waste in April 2013. TEG will remain on site during the commissioning phase, to oversee the operation and train the Viridor staff, who will ultimately be running the site.

David Nicholson, TEG's Site Manager said "the project is going well, the build is on programme and we expect to be commissioning the plant early next year."

*Long clear spans are essential for the recycling process*

# Partial factors - obscure objects of desire?

Part Two: Alastair Hughes reviews the choices available in the Eurocodes and questions 'what next?'. Part One (in the Nov/Dec 2012 issue of NSC) has been a long preamble; in this second part we come to the point.

### Design values of actions

'Design values of actions' means more or less the same as 'factored loads'.

Leave aside 'equilibrium' (EQU) verifications in which a factor less than 1 is applied to 'favourable' permanent actions (such as self weight that counters overturning). Leave aside accidental and seismic design situations, and geotechnical (GEO) verifications which have unique complications of their own. Different factors may apply in all of these, and of course in serviceability calculations, but in the remainder of this article our focus is on ordinary everyday strength (STR) verifications in which all the action is 'unfavourable'.

To evaluate 'STR' design values of actions we are referred to Table A1.2(B) of EN 1990. As first encountered in the Standard, this seems rather obscure, but some light is shed when the algebra is replaced with numbers in Table NA.A1.2(B). Further elucidation can be gained from Table A.1 of SCI publication P361 (reproduced below), in which the partial ($\gamma$) factors and their combination ($\psi$) factors are multiplied out as they would apply in a typical design situation.

Recall that all these numbers are NDPs, so this table and the remarks which follow are valid only for buildings in the UK.

### The choice

The Table offers two alternative formats. Confusingly, the first is labelled 'Eq. 6.10' (or '6.10' for short) and the second is 'Eq. 6.10a and Eq. 6.10b'. The latter option might better be described as '6.10a/b' as it is one or the other; the more onerous is taken. Clearly the intention was that each nation should come down in favour of **either** 6.10 **or** 6.10a/b, because NOTE 1 of the EN declares that 'the choice…will be in the National Annex' – though neither is recommended over the other. The UK NA fails to oblige, and declares in a NOTE 1 of its own that 'Either expression 6.10, or expression 6.10a together with and 6.10b may be made, as desired' (sic). That sentence should have been intercepted by BSI's editorial team, but in other words 'you can choose whichever you like best'. Hence the title of this article.

Which option is to be the object of our desire? The key difference is that 6.10b introduces a modification factor $\xi$, 0.925 in UK, which reduces the factor on self weight (permanent action) from 1.35 to 1.25. This means that 6.10b alone would always be advantageous over 6.10, because they treat variable actions just the same: the #1 variable action is factored 1.5, with #2 and any others subject also to combination ($\psi$) factors. Combination factors are less than 1, to reflect the statistical improbability that

**Table A.1** Partial, combination and reduction factors for the STR and GEO ultimate limit states for buildings in the UK

| Expression | Unfavourable Permanent action | Unfavourable Variable actions | | |
|---|---|---|---|---|
| | Self-weight | Imposed floor loads | Wind loads | Snow loads * |
| 6.10 | $\gamma_{G,j,sup}$ = 1.35 | $\gamma_{Q,1}$ = 1.5 | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.5 = 0.75 | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.5 = 0.75 |
| | $\gamma_{G,j,sup}$ = 1.35 | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.7 = 1.05 | $\gamma_{Q,1}$ = 1.5 | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.5 = 0.75 |
| | $\gamma_{G,j,sup}$ = 1.35 | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.7 = 1.05 | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.5 = 0.75 | $\gamma_{Q,1}$ = 1.5 |
| 6.10a + | $\gamma_{G,j,sup}$ = 1.35 | **$\gamma_{Q,1}\psi_{0,1}$ = 1.5 × 0.7 = 1.05** | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.5 = 0.75 | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.5 = 0.75 |
| | $\gamma_{G,j,sup}$ = 1.35 | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.7 = 1.05 | **$\gamma_{Q,1}\psi_{0,1}$ = 1.5 × 0.5 = 0.75** | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.5 = 0.75 |
| | $\gamma_{G,j,sup}$ = 1.35 | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.7 = 1.05 | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.5 = 0.75 | **$\gamma_{Q,1}\psi_{0,1}$ = 1.5 × 0.5 = 0.75** |
| 6.10b | $\xi\gamma_{G,j,sup}$ = 0.925 × 1.35 = 1.25 | $\gamma_{Q,1}$ = 1.5 | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.5 = 0.75 | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.5 = 0.75 |
| | $\xi\gamma_{G,j,sup}$ = 0.925 × 1.35 = 1.25 | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.7 = 1.05 | $\gamma_{Q,1}$ = 1.5 | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.5 = 0.75 |
| | $\xi\gamma_{G,j,sup}$ = 0.925 × 1.35 = 1.25 | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.7 = 1.05 | $\gamma_{Q,i}\psi_{0,i}$ = 1.5 × 0.5 = 0.75 | $\gamma_{Q,1}$ = 1.5 |

Note:

All factor values given above are taken from the National Annex to BS EN 1990.

Shaded boxes indicate the 'leading variable action'.

Bold text indicates the 'main accompanying variable action'.

The remaining variable actions are the 'other accompanying variable actions'.

\+ The same values are obtained for each of the three variations of expression (6.10a) (i.e. when each variable action in turn is treated as the main accompanying action) because the UK National Annex specifies the same value for $\gamma_{Q,1}$ and $\gamma_{Q,i}$.

* $\psi_{0,1}$ and $\psi_{0,i}$ values for snow are for buildings at an altitude of less than 1000 m above mean sea level.

more than one independent variable action will simultaneously act in full. Each significant variable action (or group of actions, if they don't act independently) is ranked #1 in turn, and all the combinations include all the actions that can coincide.

But it cannot be taken for granted that 6.10b is always available. 6.10a might be more onerous. Its purpose is to prevent the overall average load factor getting too low in situations where the load is largely dead. 6.10a factors the permanent action by 1.35, just like 6.10, but applies the combination factors to **each and every** coincident variable action (with no influence of rank). 6.10a would become more onerous than 6.10b if self weight were to exceed 4.5 times payload, which is unlikely (but not impossible – a concrete roof slab for instance). Beware however of storage loads, which for obvious reasons are not reduced in combination. Also beware of constructional situations, such as the wet concrete condition in composite construction, for which EN 1991-1-6 and its UKNA prescribe $\psi = 1$. Expression 6.10a then becomes not only more onerous than 6.10b but also identical to 6.10, effectively denying the choice. Another trap for the unwary is that $\psi$ must be taken as 1 when taking advantage of storey based live load reduction (though this Principle in EN 1991-1-1 3.3.2 (2) does not apply to area-based LLR, so $\alpha_A$ and $\psi$ may apply together!). Can the interactions of all these rules have been reasoned out by a controlling mind?

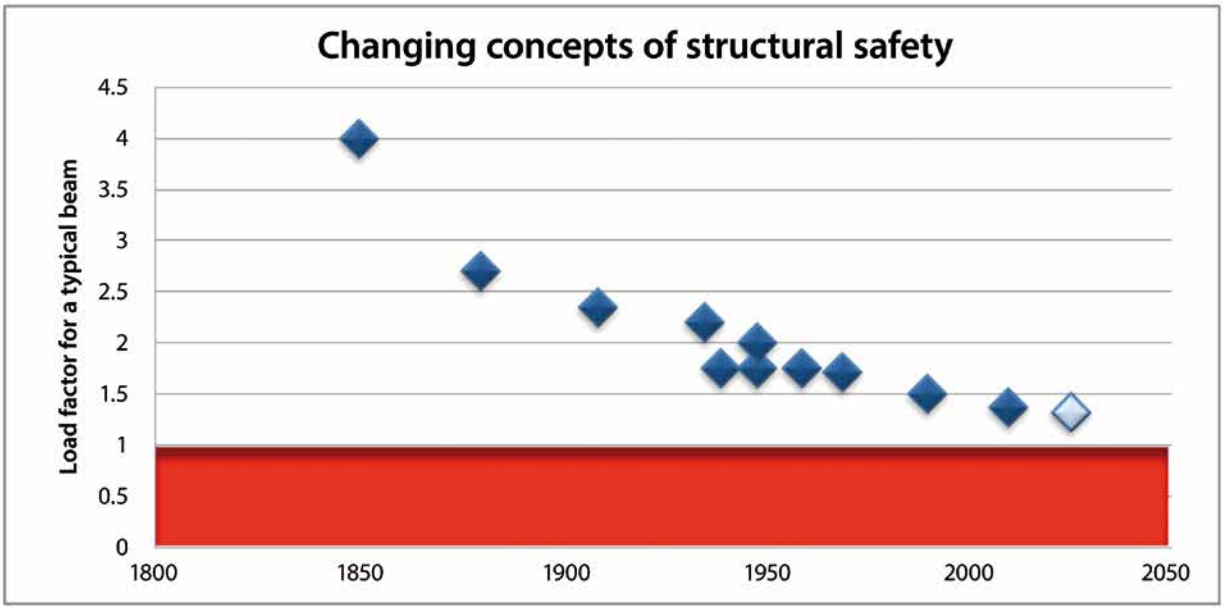
It tends to be assumed, in SCI publications and other guidance, that the automatic choice will be the 6.10a/b option because 6.10 can never be advantageous, even when 6.10a prevails over 6.10b. However 6.10 is relatively foolproof and straightforward to apply, which may be why the UK committee, like its European counterpart, sits on the fence. This author would be reluctant to criticise a designer who prefers 6.10 for its simplicity, or simply judges 1.35 to be quite low enough. You might be inclined to agree, if faced with an unpropped composite floor in which 'ponding' has increased the thickness of concrete at midspan by 20% - due to just an inch (25 mm) of deflection at the wet concrete stage.

Remarkably, the RV for $\xi$ is only 0.85, reducing the 6.10b permanent load factor still further to 1.15 in a nation which adopts it. Conspiracy theorists might point a finger at the European concrete industry! (To be fair, it should be recognised that the lower $\xi$ makes it slightly less unusual for 6.10a to prevail over 6.10b.)

But perhaps it is even more remarkable that the UK committee chose to leave a non-negligible component of the safety factor subject to the 'desire' of the designer. Typically the difference between the two options amounts to 3 to 4% in overall safety factor (on top of the circa 5% reduction previously identified). This latitude is highly unusual in Design Standards. We can only assume that 6.10a/b defines today's officially acceptable level of safety (see chart below).

Overall, the margin embodied in our structural safety paradigm for buildings has never been lower. Of course, a similar statement could have been made after most Code changes over the past century, and it is entirely proper to take a dividend in return for investment in better design. Nevertheless, as load factors decline below the psychologically important 1.5 level the question: 'how low can they go?' may pose itself. This article will not attempt an answer.

To conclude, a note of sympathy for the standardisers. Given the nature of the problem and its intractability, it may well be impossible to satisfy all the conflicting national traditions and interest groups. In an attempt to capture every nuance, and provide something for everybody, an all-embracing framework has been devised which is more complicated than anybody could have wished. For the time being nations can pick and choose, writing in their own numbers, but the force of destiny has some hard nuts to crack before true pan-European harmony can be proclaimed.




This chart is indicative of the refinement in load factor over a period which roughly corresponds to the existence of structural engineering as a profession. 19th century cast iron structures were designed to resist 4 times the load to which they would be subjected, partly to allow for hidden defects. In the permissible stress era (most of the 20th century) load factors are deduced for a mild steel beam of shape factor 1.15 (as in The Steel Skeleton Volume 2 Chapter 16). Permissible stresses progressed from 6.5 Tsi (101 MPa) at the time of the Forth Bridge to 7.5 Tsi (116 MPa) in LCC 1909 to 8 Tsi (124 MPa) in BS 449:1935, then 10 Tsi (154 MPa) in a 1939 emergency amendment which was adopted permanently after the war. (BS 449:1948 also prescribed a load factor of 2 for its 'fully rigid' design method.) The 1959 increase to 10.5 Tsi (162 MPa) reflected an increase in minimum yield stress from 15.25 Tsi (S236) to 16 Tsi (S247) in BS 15. Metrication nudged 10.5 Tsi up to 165 MPa cf BS 4360:Part 2:1969's S245 [actually a reduction from 16.5 Tsi (S255) in BS 4360:1968]. Post 1990, factors are explicit; equal live and dead load is assumed; hence 1.5 as the average of 1.4 and 1.6, and so on. The pale blue marker is speculative, to be inked in if the UK were to adopt RVs in the Eurocode by (say) 2025.

# New and revised codes & standards

**From BSI Updates November 2012, December 2012 and January 2013**

## BS EN PUBLICATIONS

**BS EN ISO 13588:2012**
Non-destructive testing of welds. Ultrasonic testing. Use of automated phased array technology
*No current standard is superseded*

**BS EN ISO 4136:2012**
Destructive tests on welds in metallic materials. Transverse tensile test.
*Supersedes BS EN ISO 4136:2011*

**BS EN ISO 9016:1012**
Destructive tests on welds in metallic materials. Impact tests. Test specimen location, notch orientation and examination
*Supersedes BS EN ISO 9016:2011*

## BS IMPLEMENTATIONS

**BS ISO 16160:2012**
Hot-rolled steel sheet products. Dimensional and shape tolerances
*Supersedes BS ISO 16160:2011*

## BRITISH STANDARDS PROPOSED FOR CONFIRMATION

**BS 3692:2001**
ISO metric precision hexagon bolts, screws and nuts. Specification

**BS 4190:2001**
ISO metric black hexagon bolts, screws and nuts. Specification

## BRITISH STANDARDS PROPOSED FOR WITHDRAWAL

**BS 5493:1977**
Code of practice for protective coating of iron and steel structures against corrosion
*This standard is proposed for withdrawal as it is partially superseded by BS EN ISO 12944-1:1998, BS EN ISO 12944-2:1998, BS EN ISO 12944-3:1998, BS EN ISO 12944-4:1998; BS EN ISO 12944-5:2007, BS EN ISO 12944-6:1998; BS EN ISO 12944-7:1998, BS EN ISO 12944-8:1998 and BS EN ISO 14713:1999*

## CEN EUROPEAN STANDARDS

**EN 1991-1-2:-**
Eurocode 1. Actions on structures. General actions. Actions on structures exposed to fire
CORRIGENDUM 2: November 2012 to EN 1991-1-2:2002

**EN 1991-1-6:-**
Eurocode 1. Actions on structures. General actions. Actions during execution
CORRIGENDUM 2: November 2012 to EN 1991-1-6:2005

**EN 1991-4:-**
Eurocode 1. Actions on structures. General actions. Silos and tanks.
CORRIGENDUM 1: November 2012 to EN 1991-4:2006

## NEW WORK STARTED

**EN 1993-1-1:2005/A1**
Eurocode 3. Design of steel structures. General rules and rules for buildings

**EN 1994-1-2:2005/A1**
Eurocode 4. Design of composite steel and concrete structures. General rules. Structural fire design

**EN 1997-1:2004/A1**
Eurocode 7. Geotechnical design. General rules

**EN ISO 9017**
Destructive tests on welds in metallic materials. Fracture test

**EN ISO 9606-1**
Qualification test of welders. Fusion welding. Steels

**EN ISO 10675-1**
Non-destructive testing of welds. Evaluation of welded joints in steel, nickel, titanium and their alloys by radiography. Acceptance levels

**EN ISO 15626**
Non-destructive testing of welds. Time-of-flight diffraction technique (TOFD). Acceptance levels.

# AD 372
# Vibration checks of floors

A number of methods are available to check the dynamic response of a floor. This advisory note discusses the appropriate application of the various approaches.

The assessment methods commonly used are:

- The traditional simple check of floor frequency
- A general method, involving finite element (FE) analysis of the floor
- A simplified response factor method, described in SCI P354[1]
- American Institute of Steel Construction (AISC) Steel Design Guide 11[2]

The traditional approach has been to ensure that the natural frequency of beams and slab exceeds 4 Hz. This check is based on the assumption that above this frequency, the floor is "tuned out" of the frequency range of the first harmonic component of the walking activity; resonance is avoided. The traditional approach is simple to apply but does not consider such effects as damping, the mass of the floor, or the possibility of resonance at higher harmonics.

Many modern standards have moved away from this traditional approach and require the designer to compare the floor response with criteria that reflect human perception in different environments, such as in offices, residential accommodation or hospitals. Reference is usually made to BS 6472-1[3] or ISO 10137[4], which specify acceptable levels of vibrations in buildings. To calculate the floor response, designers commonly use SCI publication P354 or AISC Steel Design Guide 11.

SCI P354 provides two design methods: a general method and a simplified method. The general method may be used for any floor type and any type of human activity; the method is based on FE modelling and response analysis. FE analysis is accurate and reliable, but is generally usually only used by specialists.

The simplified method is suitable for hand calculations, but is limited to steel-concrete composite floors subject to walking activities. The simplified method is based on a large number of FE models analysed using the general method and was calibrated to be conservative in all design situations.

The simplified method described in P354 has become popular with both designers and clients, and is often specified as the approach to be followed. However, the method does have limitations, and some designers have found the simplified method to be unduly conservative at shorts spans.

With short spans, an alternative method, such as that recommended by AISC, may suggest a less conservative design would still perform acceptably. The two methods have been compared with the conclusion that both the method in P354 and the AISC design guide produce satisfactory predictions of the fundamental frequency for steel-composite floor systems; both may be used with confidence.[5]

The P354 Simplified Method need not be specified as the de facto approach to be followed, as other authoritative methods are available, and, in some circumstances, may demonstrate that a less conservative solution is adequate.

[1] SCI P354, Design of Floors for Vibration: A New Approach (Revised Edition, February 2009) by A L Smith, S J Hicks and P J Devine
[2] AISC Steel Design Guide 11, Floor Vibrations due to human activity (1st Printing June 1, 2009) by Thomas M Murray, David E Allen and Eric E Ungar
[3] BS 6472-1 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting, BSI, 2008
[4] ISO 10137, Bases for design of structures – Serviceability of buildings against vibration, International Organisation for Standardization, 2007
[5] Stephen Hicks, Progress in Structural Engineering and Materials Journal, Vol 6, No 1 January-March 2004

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# Structural Steelwork in Newspaper Buildings

Contributed by
Ellis, Clarke & Gallanaugh
Chartered Architects

FROM BUILDING WITH STEEL NOVEMBER 1962

In designing the framework of a building to house newspaper plant and offices and in choosing the material to be used in its construction, the designer must give due regard not only to the present requirements of the building but also anticipate possible future requirements. An objective study of the of the function of this type of building will soon show one material to have outstanding advantages over all others and, in fact, to be the automatic choice of any architect or engineer with experience of this building type. The same material is the universal preference of the works engineer, the man who has to live with the building.

The material with these advantages is structural steelwork and, primarily, its favoured position results from its flexibility both in initial construction and alterations. It is this quality of flexibility that has allowed major changes to be made in course of construction due to new plant being announced and which has allowed buildings erected 75 years ago to be kept up-to-date as production units and still to have a recognisable framework.

The main design feature of a building of this type is the heavy floor loadings required for almost all areas, including those sometimes thought of as office areas, combined with a preference for uninterrupted floor areas from choice in some departments and for operating efficiency in others. This latter feature is complicated by the fact that a newspaper functions most efficiently in a multi-storey building and by the fact that the areas requiring clear floor space for efficiency are those forming the lowest storeys of the building. The main units in this category are the publishing or despatch department and the press or the machine room.

In the case of the press room, the clear spans required are in the region of 55 ft. to 100 ft. depending on the number of lines of presses and the direction. Providing spans of this order is complicated by the necessity to support floors with fairly heavy loadings on the structure spanning these areas. These floor loadings can be in the order of 4 cwt per sq. ft. The design of the supporting structure is further complicated, particularly in metropolitan and urban areas, by the necessity to keep the depth of construction to a minimum because of planning and other regulations governing height.

In considering this problem, the designer must also keep well in mind the effect of the construction on the type of floor to be provided. In newspaper buildings, a large number of holes are required in floors, particularly in the lower parts of the building and a good proportion of these are required to be formed after construction. Because of this, special composite systems of construction which, under

Left: Main entrance front, new offices and printing works, The Western Mail & Echo, Cardiff, for Thomson Newspapers

Right: New offices for the Sunday Times and the headquarters of Thomson Newspapers, Grays Inn Road

Below: Offices and printing works for the West Briton and Royal Cornwall Gazette, Truro


some conditions, reduce the depth and weight of construction to a minimum, are unsuitable for this type of building. Invariably, the use of special systems of construction involves the acceptance of limitations in the adaptation of the structure at a later date.

Of simple systems of construction, structural steelwork offers the shallowest and lightest construction. Where, of necessity, columns must be introduced internally in the building, particularly in relation to the press room, the reduction in cross-sectional area of steel columns compared with those of other materials and the consequent reduction in the obstruction resulting from their use is an obvious advantage.

In favouring structural steelwork for its flexibility, the designer provides the building owner with structural system most likely to produce a building with a long efficient life for the production of his newspaper. It is unusual for a newspaper building to be designed, built and equipped in one operation. Although the building may be built as a complete unit, installation of the equipment will almost certainly be spread over a number of years. Under such conditions it is obvious that new plant may appear and that the building owner may have second thoughts on plant layout. If he is to be in a position to install up-to-date plant or alter his layout in search of increased efficiency, he must be able to adapt his existing building.

While it is not denied that adaptation and alteration can be carried out to buildings of other structural systems it is contended that only a structural steelwork frame can be successfully altered and adapted under the conditions prevailing in and peculiar to the newspaper industry. Among these conditions are:

- A daily newspaper with an associated Sunday newspaper misses publication on only three days a year, Good Friday, Christmas Day and Boxing Day.
- Delay of even minutes in producing an edition can drastically reduce circulation.
- Because of the nature of his business, the newspaper proprietor is limited in position and choice of sites.

Consequently, all alterations must be carried out with the building in full production and any disturbance to production departments must not interfere with or delay production. With a structural frame of steel these considerations can be fulfilled.

A further contention is that only with a frame of structural steelwork will the building survive the peculiar conditions of life in a newspaper industry as a frame building and not become obsolete in a fairly short space of time.

# Steelwork contractors for buildings

BCSA is the national organisation for the steel construction industry.
Membership of BCSA is open to any Steelwork Contractor who has a fabrication facility within the United Kingdom or Republic of Ireland.
Details of BCSA membership and services can be obtained from
Gillian Mitchell MBE, Deputy 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
- **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 | SCM | Guide Contract Value (1) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A C Bacon Engineering Ltd | 01953 850611 | | | ● | ● | | ● | | | | | | | | | | | Up to £2,000,000 |
| Adey Steel Ltd | 01509 556677 | | | | ● | ● | ● | ● | | ● | ● | | | ● | ● | | Member | Up to £2,000,000 |
| Adstone Construction Ltd | 01905 794561 | | | ● | ● | ● | | | | | | | | | | ✓ | | Up to £3,000,000 |
| Advanced Fabrications Poyle Ltd | 01753 531116 | | | | ● | | ● | ● | ● | ● | ● | | | | ● | | | Up to £800,000 |
| Alex Morton Contracts Ltd | 028 9269 2436 | | | ● | ● | ● | ● | | ● | ● | ● | | | ● | ● | | | Up to £400,000 |
| Angle Ring Company Ltd | 0121 557 7241 | | | | | | | | | | | | ● | | | | | Up to £1,400,000 |
| Apex Steel Structures Ltd | 01268 660828 | | | | ● | | ● | | | ● | ● | | | | | | | Up to £800,000 |
| Arminhall Engineering Ltd | 01799 524510 | ● | | | ● | | | | | ● | ● | | | ● | ● | | | Up to £200,000 |
| Arromax Structures Ltd | 01623 747466 | ● | | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | | | Up to £800,000 |
| ASA Steel Structures Ltd | 01782 566366 | | | ● | ● | ● | ● | | | ● | ● | | | ● | ● | | | Up to £800,000* |
| ASD Westok Ltd | 0113 205 5270 | | | | | | | | | | | | ● | | | ✓ | | Up to £6,000,000 |
| ASME Engineering Ltd | 020 8966 7150 | | | | ● | | | | | ● | ● | | | ● | ● | ✓ | | Up to £800,000* |
| Atlas Ward Structures Ltd | 01944 710421 | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | ✓ | Gold | Above £6,000,000 |
| Atlasco Constructional Engineers Ltd | 01782 564711 | | | ● | ● | ● | ● | | | | ● | | | ● | ● | | | Up to £1,400,000 |
| Austin-Divall Fabrications Ltd | 01903 721950 | | | ● | ● | | ● | ● | | ● | ● | | | ● | ● | | | Up to £400,000 |
| 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 | | | | | | | | | | | | ● | | | ✓ | | Up to £800,000 |
| BHC Ltd | 01555 840006 | ● | ● | ● | ● | ● | ● | | | | ● | ● | | ● | ● | ✓ | | Above £6,000,000 |
| Billington Structures Ltd | 01226 340666 | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | | ✓ | Gold | Above £6,000,000 |
| Border Steelwork Structures Ltd | 01228 548744 | | | ● | ● | ● | ● | | | ● | ● | | | | ● | | | Up to £3,000,000 |
| Bourne Construction Engineering Ltd | 01202 746666 | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ✓ | Gold | Above £6,000,000 |
| Briton Fabricators Ltd | 0115 963 2901 | ● | | ● | ● | ● | ● | ● | ● | ● | ● | | | ● | ● | ✓ | | Up to £3,000,000 |
| Cairnhill Structures Ltd | 01236 449393 | ● | | | ● | ● | ● | ● | ● | ● | ● | | | ● | ● | ✓ | Gold | Up to £2,000,000 |
| Caunton Engineering Ltd | 01773 531111 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | ✓ | Gold | Up to £6,000,000 |
| Cleveland Bridge UK Ltd | 01325 381188 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | | ✓ | Silver | Above £6,000,000 |
| CMF Ltd | 020 8844 0940 | | | | ● | | ● | ● | | ● | ● | | | | ● | ✓ | | Up to £6,000,000 |
| Cordell Group Ltd | 01642 452406 | ● | | | ● | ● | ● | ● | ● | ● | ● | | | | | ✓ | | Up to £3,000,000 |
| Coventry Construction Ltd | 024 7646 4484 | | | ● | ● | ● | ● | ● | ● | ● | ● | | | ● | ● | | | Up to £800,000 |
| D H Structures Ltd | 01785 246269 | | | ● | ● | | ● | | | | ● | | | ● | | | | Up to £100,000 |
| Discain Project Services Ltd | 01604 787276 | | | | ● | | | | | ● | ● | | | | ● | ✓ | | Up to £1,400,000 |
| Duggan Steel Ltd | 00 353 29 70072 | | ● | ● | ● | ● | ● | ● | | | ● | | | | | ✓ | | Up to £6,000,000 |
| ECS Engineering Services Ltd | 01773 860001 | ● | | ● | ● | ● | ● | ● | ● | ● | ● | | | ● | ● | ✓ | | Up to £2,000,000 |
| Elland Steel Structures Ltd | 01422 380262 | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | | ✓ | Gold | Up to £6,000,000 |
| EvadX Ltd | 01745 336413 | | | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | ✓ | Gold | Up to £3,000,000 |
| Fisher Engineering Ltd | 028 6638 8521 | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | ✓ | Gold | Above £6,000,000 |
| 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 | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | | ✓ | Silver | 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 |
| H Young Structures Ltd | 01953 601881 | | | ● | ● | ● | ● | ● | | | | | | ● | | | Member | Up to £2,000,000 |
| Had Fab Ltd | 01875 611711 | | | | ● | | | | ● | ● | ● | | | | ● | ✓ | | Up to £2,000,000 |
| Hambleton Steel Ltd | 01748 810598 | | ● | ● | ● | ● | ● | ● | | | | ● | | ● | | ✓ | Silver | Up to £2,000,000 |
| Harry Marsh (Engineers) Ltd | 0191 510 9797 | | | ● | ● | ● | ● | | | | ● | ● | | | ● | ✓ | | Up to £1,400,000 |
| Henry Smith (Constructional Engineers) Ltd | 01606 592121 | | | ● | ● | ● | ● | ● | | | | | | | | | | Up to £3,000,000 |
| Company name | Tel | C | D | E | F | G | H | J | K | L | M | N | Q | R | S | QM | SCM | Guide Contract Value (1) |

| Company name | Tel | C | D | E | F | G | H | J | K | L | M | N | Q | R | S | QM | SCM | Guide Contract Value (1) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hescott Engineering Company Ltd | 01324 556610 | | | ● | ● | ● | ● | | | ● | | | | ● | ● | | | Up to £3,000,000 |
| Hills of Shoeburyness Ltd | 01702 296321 | | | | | | | | | ● | | | | ● | ● | | | Up to £1,400,000 |
| J Robertson & Co Ltd | 01255 672855 | | | | | | | | | ● | ● | | | | ● | | | Up to £200,000 |
| James Killelea & Co Ltd | 01706 229411 | | ● | ● | ● | ● | ● | | | | | ● | | ● | | | | Up to £6,000,000* |
| Kiernan Structural Steel Ltd | 00 353 43 334 1445 | | | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | ✓ | ● (orange) | Up to £4,000,000 |
| Leach Structural Steelwork Ltd | 01995 640133 | | | ● | ● | ● | ● | ● | | | ● | | | | | | ● (green) | Up to £2,000,000 |
| 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 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ✓ | ● (orange) | Above £6,000,000 |
| Mackay Steelwork & Cladding Ltd | 01862 843910 | | | ● | ● | | ● | | | ● | ● | | | ● | ● | | | 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 | | | | | | ● | ● | ● | ● | | | | | | ✓ | | Up to £4,000,000 |
| On Site Services (Gravesend) Ltd | 01474 321552 | | | | ● | | ● | ● | | ● | ● | | | | ● | | | Up to £200,000 |
| 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 | | | | | | | | ● | | ● | | | | ● | ✓ | ● (grey) | 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 |
| REIDsteel | 01202 483333 | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | | | | Up to £6,000,000 |
| Remnant Plant Ltd | 01594 841160 | | | | ● | | ● | ● | ● | ● | ● | | | | ● | ✓ | | Up to £400,000 |
| Rippin Ltd | 01383 518610 | | | ● | ● | ● | ● | ● | | | | | | ● | ● | | | Up to £1,400,000 |
| Rowecord Engineering Ltd | 01633 250511 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ✓ | ● (orange) | Above £6,000,000 |
| S H Structures Ltd | 01977 681931 | | | | | | ● | ● | ● | ● | | ● | | | | ✓ | ● (grey) | Up to £3,000,000 |
| Severfield-Watson Structures Ltd | 01845 577896 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ✓ | ● (orange) | Above £6,000,000 |
| Shipley Fabrications Ltd | 01400 251480 | | | ● | ● | ● | ● | | ● | ● | ● | | | ● | ● | | | Up to £1,400,000 |
| SIAC Butlers Steel Ltd | 00 353 57 862 3305 | | ● | ● | ● | ● | ● | ● | ● | | ● | ● | | | | ✓ | ● (green) | Above £6,000,000 |
| SIAC Tetbury Steel Ltd | 01666 502792 | | | ● | ● | ● | ● | | ● | | ● | ● | | ● | | ✓ | ● (grey) | Up to £2,000,000 |
| Snashall Steel Fabrications Co Ltd | 01300 345588 | | | ● | ● | ● | ● | ● | | | ● | | | | ● | | | Up to £1,400,000 |
| South Durham Structures Ltd | 01388 777350 | | | ● | ● | ● | | | | ● | ● | ● | | | ● | | | Up to £800,000 |
| Temple Mill Fabrications Ltd | 01623 741720 | | | ● | ● | ● | ● | | | | ● | | | ● | ● | | | Up to £200,000 |
| Traditional Structures Ltd | 01922 414172 | | ● | ● | ● | ● | ● | ● | ● | | ● | ● | | ● | | ✓ | ● (grey) | Up to £2,000,000 |
| TSI Structures Ltd | 01603 720031 | | | ● | ● | ● | ● | | | | | | | | | | | Up to £1,400,000 |
| Tubecon | 01226 345261 | | | | | | ● | ● | ● | ● | | | | ● | ● | ✓ | ● (orange) | 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 | | | ● | ● | ● | | | ● | ● | ● | | | | | ✓ | ● (grey) | Up to £2,000,000 |
| William Hare Ltd | 0161 609 0000 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | | ✓ | ● (orange) | Above £6,000,000 |
| Company name | Tel | C | D | E | F | G | H | J | K | L | M | N | Q | R | S | QM | 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
**SCM** Steel Construction Sustainability Charter
(● Gold) = Gold, (● Silver) = Silver, (● Member) = Member

| Company name | Tel | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | SCM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AceCad Software Ltd | 01332 545800 | | ● | | | | | | | | |
| Albion Sections Ltd | 0121 553 1877 | ● | | | | | | | | | |
| Andrews Fasteners Ltd | 0113 246 9992 | | | | | | | | | ● | |
| ArcelorMittal Distribution – Birkenhead | 0151 647 4221 | | | | | | | | ● | | |
| ArcelorMittal Distribution – South Wales | 01633 627890 | | | | | | | | ● | | |
| ArcelorMittal Distribution – Scunthorpe | 01724 810810 | | | | | | | | ● | | |
| ASD metal services | 0113 254 0711 | | | | | | | | ● | | |
| Ayrshire Metal Products (Daventry) Ltd | 01327 300990 | ● | | | | | | | | | |
| BAPP Group Ltd | 01226 383824 | | | | | | | | | ● | |
| Barnshaw Plate Bending Centre Ltd | 0161 320 9696 | ● | | | | | | | | | |
| Barrett Steel Ltd | 01274 682281 | | | | | | | | ● | | |
| BW Industries Ltd | 01262 400088 | ● | | | | | | | | | |
| Cellbeam Ltd | 01937 840600 | ● | | | | | | | | | |
| Cellshield Ltd | 01937 840600 | | | | | | | ● | | | |
| CMC (UK) Ltd | 029 2089 5260 | | | | | | | | ● | | |
| Composite Profiles UK Ltd | 01202 659237 | ● | | | | | | | | | |
| Computer Services Consultants (UK) Ltd | 0113 239 3000 | | ● | | | | | | | | |
| Cooper & Turner Ltd | 0114 256 0057 | | | | | | | | | ● | |
| Cutmaster Machines UK Ltd | 01226 707865 | | | | | ● | | | | | |
| Daver Steels Ltd | 0114 261 1999 | ● | | | | | | | | | |
| Easi-edge Ltd | 01777 870901 | | | | | | | ● | | | Gold |
| Fabsec Ltd | 0845 094 2530 | ● | | | | | | | | | |
| FabTrol Systems UK Ltd | 01274 590865 | | ● | | | | | | | | |
| Ficep (UK) Ltd | 01924 223530 | | | | | ● | | | | | |
| FLI Structures | 01452 722200 | ● | | | | | | | | | Silver |
| Forward Protective Coatings Ltd | 01623 748323 | | | | | | ● | | | | |

# Steelwork contractors for bridgeworks

RQSC
The Register of Qualified Steelwork Contractors Scheme

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
**SCM** Steel Construction Sustainability Charter ((● Gold) = Gold, (● Silver) = Silver, (● Member) = 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 | 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 | ● | ● | ● | ● | | | ● | ● | ✓ | | | Gold | Up to £2,000,000 |
| Cleveland Bridge UK Ltd | 01325 381188 | ● | ● | ● | ● | ● | ● | ● | ● | ✓ | ✓ | ✓ | Silver | Above £6,000,000 |
| Four-Tees Engineers Ltd | 01489 885899 | ● | ● | ● | ● | | ● | ● | ● | ✓ | | ✓ | Member | Up to £2,000,000 |
| Kiernan Structural Steel Ltd | 00 353 43 334 1445 | ● | ● | ● | ● | | | ● | ● | ✓ | | | Gold | Up to £800,000 |
| Mabey Bridge Ltd | 01291 623801 | ● | ● | ● | ● | ● | ● | ● | ● | ✓ | ✓ | ✓ | Gold | Above £6,000,000 |
| Nusteel Structures Ltd | 01303 268112 | ● | ● | ● | ● | ● | | ● | ● | ✓ | ✓ | ✓ | | Up to £4,000,000 |
| Painter Brothers Ltd | 01432 374400 | ● | | ● | | | | | ● | ✓ | | | Silver | Up to £6,000,000 |
| Remnant Plant Ltd | 01594 841160 | ● | ● | ● | | | | | ● | ✓ | | | | Up to £400,000 |
| Rowecord Engineering Ltd | 01633 250511 | ● | ● | ● | ● | ● | ● | ● | ● | ✓ | ✓ | ✓ | Gold | Above £6,000,000 |
| S H Structures Ltd | 01977 681931 | ● | | ● | ● | ● | | | ● | ✓ | | ✓ | Silver | Up to £3,000,000 |
| Severfield-Watson Structures Ltd | 01204 699999 | ● | ● | ● | ● | ● | ● | ● | ● | ✓ | | ✓ | Gold | Above £6,000,000 |
| SIAC Butlers Steel Ltd | 00 353 57 862 3305 | ● | ● | ● | ● | ● | | ● | ● | ✓ | | | Member | Above £6,000,000 |
| **Non-BCSA member** | | | | | | | | | | | | | | |
| ABC Bridges Ltd | 0845 0603222 | ● | | | | | | | | ✓ | | | | Up to £100,000 |
| Allerton Steel Ltd | 01609 774471 | ● | ● | ● | ● | ● | ● | ● | ● | ✓ | | | | Up to £1,400,000 |
| Cimolai Spa | 01223 350876 | ● | ● | ● | ● | ● | ● | | | ✓ | | | | Above £6,000,000 |
| Concrete & Timber Services Ltd | 01484 606416 | ● | ● | ● | | ● | ● | | ● | ✓ | | | Member | Up to £800,000 |
| Donyal Engineering Ltd | 01207 270909 | ● | | | | | | ● | ● | ✓ | | ✓ | Member | Up to £1,400,000 |
| Francis & Lewis International Ltd | 01452 722200 | | | | | | | ● | ● | ✓ | | | Silver | 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* |
| Millar Callaghan Engineering Services Ltd | 01294 217711 | ● | | | | | | ● | | ✓ | | | | Up to £800,000 |
| P C Richardson & Co (Middlesbrough) Ltd | 01642 714791 | ● | | | | | | ● | ● | ✓ | | | | Up to £3,000,000 |
| The Lanarkshire Welding Company Ltd | 01698 264271 | ● | ● | ● | ● | ● | ● | ● | ● | ✓ | | | Member | Up to £2,000,000 |
| Varley & Gulliver Ltd | 0121 773 2441 | ● | | | | | | ● | ● | ✓ | | ✓ | | Up to £4,000,000 |

| Company name | Tel | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | SCM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Goodwin Steel Castings Ltd | 01782 220000 | ● | | | | | | | | | |
| Graitec UK Ltd | 0844 543 888 | | ● | | | | | | | | |
| Hadley Rolled Products Ltd | 0121 555 1342 | ● | | | | | | | | | ● (grey) |
| Hempel UK Ltd | 01633 874024 | | | | | | ● | | | | |
| Hi-Span Ltd | 01953 603081 | ● | | | | | | | | | ● (green) |
| Highland Metals Ltd | 01343 548855 | | | | | | ● | | | | |
| Hilti (GB) Ltd | 0800 886100 | | | | | | | | | ● | |
| International Paint Ltd | 0191 469 6111 | | | | | | ● | | | | ● (orange) |
| Jack Tighe Ltd | 01302 880360 | | | | | | ● | | | | |
| Jamestown Cladding and Profiling | 00 353 45 434288 | ● | | | | | | | | | |
| Jotun Paints (Europe) Ltd | 01724 400000 | | | | | | ● | | | | |
| Kaltenbach Ltd | 01234 213201 | | | | | ● | | | | | |
| Kingspan Structural Products | 01944 712000 | ● | | | | | | | | | ● (orange) |
| Leighs Paints | 01204 521771 | | | | | | ● | | | | ● (grey) |
| Lindapter International | 01274 521444 | | | | | | | | | ● | |
| Metsec plc | 0121 601 6000 | ● | | | | | | | | | ● (orange) |
| MSW | 0115 946 2316 | ● | | | | | | | | | |

| Company name | Tel | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | SCM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Murray Plate Group Ltd | 0161 866 0266 | | | | | | | | ● | | |
| National Tube Stockholders Ltd | 01845 577440 | | | | | | | | ● | | |
| John Parker & Sons Ltd | 01227 783200 | | | | | | | | ● | ● | |
| Peddinghaus Corporation UK Ltd | 01952 200377 | | | | | ● | | | | | |
| PPG Performance Coatings UK Ltd | 01773 814520 | | | | | | ● | | | | |
| Prodeck-Fixing Ltd | 01278 780586 | ● | | | | | | | | | |
| Rainham Steel Co Ltd | 01708 522311 | | | | | | | | ● | | |
| Structural Metal Decks Ltd | 01202 718898 | ● | | | | | | | | | ● (green) |
| Tata Steel | 01724 404040 | | | | ● | | | | | | |
| Tata Steel Distribution (UK & Ireland) | 01902 484100 | | | | | | | | ● | | |
| Tata Steel Service Centres Ireland | 028 9266 0747 | | | | | | | | ● | | |
| Tata Steel Service Centre Dublin | 00 353 1 405 0300 | | | | | | | | ● | | |
| Tata Steel Tubes | 01536 402121 | | | | ● | | | | | | |
| Tata Steel UK Panels & Profiles | 0845 308 8330 | ● | | | | | | | | | |
| Tekla (UK) Ltd | 0113 307 1200 | | ● | | | | | | | | |
| Tension Control Bolts Ltd | 01948 667700 | | | | | | ● | | | ● | |
| Wedge Group Galvanizing Ltd | 01909 486384 | | | | | | ● | | | | |

# EVERYTHING YOU NEED TO KNOW ABOUT UK STEEL CONSTRUCTION

# www.steelconstruction.info

# ANY QUESTIONS?

**SteelConstruction.info** is the new online encyclopaedia for UK steel design and construction information.

Developed and maintained by the British Constructional Steelwork Association, Tata Steel and the Steel Construction Institute, the site brings together a wealth of information in an easy to use, fully searchable format that is constantly updated.

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