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NSC

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Nov/Dec 2014
Vol 22 No 7

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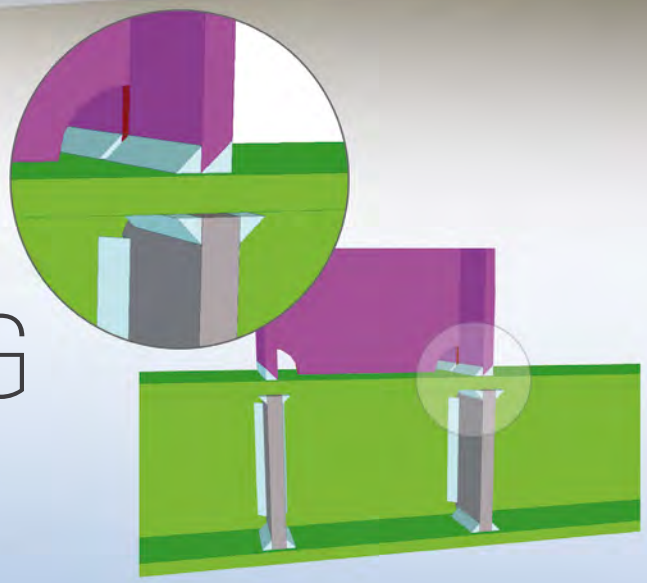

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Steelwork contractor:
Severfield
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Steel tops the bill

Nick Barrett - Editor

Sustainability is never very far away from the top of the construction agenda, and the steel sector supply chain has excelled at providing structures that tick all the sustainability boxes as well as providing cost efficient and attractive buildings.

Steel has played a key role in helping London become an international hot spot for sustainable architecture, used for a wide range of strikingly impressive structures like the Shard and the Leadenhall Building, or Cheesegrater. All are winners of many awards recognising their design and construction and sustainability excellence.

The sustainability goal posts have been set not necessarily higher, but perhaps a bit further back down the pitch with the award of the first BREEAM UK New Construction 2014 certificate for building design. BREEAM New Construction 2014 is the latest update of the BREEAM standard for new buildings, launched in May after the biggest ever consultation on a BREEAM scheme.

It has gone to the design by architect Kohn Pedersen Fox and structural engineer Arup for a £500 million, 190 metre tower at 52 Lime Street that will have 35 floors plus two basement levels and two roof plant levels. The striking design – nicknamed the Scalpel - demonstrates that energy efficiency can be achieved by modern architecture while creating exemplary indoor environmental quality.

It has been given an Excellent rating and it is of course designed in steel; we hope to bring you further details about it next year.

In this issue we have revisited another BREEAM luminary, the Structural Steel Design Awards finalist First Direct Arena in Leeds which gained a BREEAM 'Very Good' score, the highest achieved by a UK arena.

Large column free spaces are obvious requirements of arenas so steel was always going to top the bill at Leeds, but the high sustainability targets set by the client, Leeds City Council, also demanded a steel solution. International acclaim for the arena includes winning a New Venue of the Year award, beating off competition from around the world.

Our revisit found that world famous performers liked the venue – Rod Stewart reportedly said its acoustics are the best on this side of the Atlantic – and the arena is generating some £25 million a year for the local economy; ticking the economic box has of course a sustainability quality all of its own.

Other major news in this issue is the announcement that Tata Steel Europe is in talks with the Klesch Group to sell its Long Products division, the part of the company that makes heavy steel sections. The talks are likely to take some months but the message from Tata Steel is very much one of business as usual. Customers shouldn't notice any difference in the high quality of service that they are used to receiving from either Tata Steel or the rest of the steel sector.

It doesn't seem so long ago that another transition was under way when Tata Steel bought Corus. That was seamless and there is no reason why if the talks result in a change of ownership that the same should not happen this time.

Gary Klesch, Founder and Chairman of the Klesch Group said his company has deep experience in the long products sector. He believes there is a growing market for these products and the Klesch Group intend to capitalise on this demand.

NSC

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Business as usual pledge as Long Products sales talks proceed

Tata Steel promises business as usual while due diligence is under way on the proposed sale of its European Long Products businesses to The Klesch Group.

A memorandum of understanding has been signed by Tata Steel and The Klesch Group to undertake negotiations for the sale which includes Tata Steel's heavy sections business, the part of most interest to construction designers.

The Klesch Group will now undertake an extensive detailed due diligence and if successful both companies hope to complete the transaction in the first half of 2015.

The sale would include Tata Steel's Scunthorpe steelworks, mills in Teesside, Dalzell and Clydebridge in Scotland, an engineering workshop in Workington and an engineering design consultancy in York, as well as other operations in France and Germany.

Tata Steel says full, normal services will be maintained to customers throughout the negotiations and the company's focus on quality and delivery will be unaffected.

The company has invested heavily in the UK Long Products business since acquiring Corus in January 2007, with investment of some £190M in the past three years alone. A £30M reline of the Queen Anne blast furnace at Scunthorpe has just been completed.

Karl Köhler, Chief Executive of Tata Steel's European operations, said: "We are making huge strides on our strategic journey to become a premium, customer-centred steel company thanks to investment in equipment, technology and customers, together with the substantial contributions from our employees.

"We've improved the competitiveness of Tata Steel's European operations, including Long Products Europe which now supplies more of the innovative steel rail, rod, plate, sections and special profile products demanded by customers."

The Klesch Group is a global industrial commodities business specialising and trading in chemicals, metals and oil, and employing more than 2,000 people in 17 countries.

Gary Klesch, Founder and Chairman of the Klesch Group said: "We are delighted to announce this agreement with Tata Steel regarding the Long Products Europe business and associated distribution activities.

"The Klesch Group has deep experience in the long products sector, and I look forward to sharing this experience with their team. We believe there is a growing market for the first class products made by this business and we intend to capitalise on this demand."

Rebirth of former London hospital site

Steelwork erection for the Fitzroy Place development in central London has finished ahead of the entire scheme completing early next year.

Severfield has fabricated, supplied and erected approximately 2,300t of steelwork for two offices blocks that are nine storeys and eight storeys high respectively.

The office blocks both feature centrally located cores and are built around grid patterns of up to 12m × 6m.

Being built on the site of the former Middlesex Hospital, the Fitzroy Place scheme also includes the first new square in London W1 for more than 100 years, 230 residences as well as restaurants and retail outlets.

Steel extension for film manufacturer

One of Cumbria's leading employers is expanding its manufacturing facility with a new steel extension that has been constructed without disrupting onsite production.

Headquartered in Wigton, near Carlisle, Innovia Films is a global manufacturer of two speciality products, Biaxially Orientated Polypropylene (BOPP) and cellulose based films and these are supplied into the packaging, labels, tobacco overwrap and securities markets.

The company is currently undertaking a £20M investment package that includes the construction of an additional BOPP production area that will help increase output by up to 10%.

The new facility is a steel-framed extension added to the existing BOPP production building.

"Our BOPP production process is a 24/7 operation and the steel extension is being built in such a manner that it doesn't interrupt the work in any way," said Simon Butcher, Innovia Films Senior Design and Development Engineer.

The new steel frame has been bolted on to one end of the existing building. In order to not cause any disruption during the erection process, steelwork contractor Border Steelwork Structures initially cut openings in the existing building's cladding to allow for each steel beam connection between the new and old frames to maintain a barrier between construction and production work.

Olympic Stadium races towards conversion

Work on the former London Olympic Stadium is progressing on schedule as main contractor Balfour Beatty has begun installing a new transparent roof, which on completion will be largest spanning tensile roof in the world.

As well as installing steelwork for the roof the works have also included alterations and strengthening to the stadium's terracing structure. This has not only facilitated the new roof but also the retractable seating system that will be added to all four sides of the ground.

A movable seating arrangement will cover the athletics track and allow spectators to be closer to the action during football matches. Importantly, it also means the venue can become the new national competition stadium for UK athletics.

The former 2012 Olympic venue is being converted into a 54,000 seat capacity stadium to be used by West Ham United from 2016.

Prior to this the stadium will also host five matches during the 2015 Rugby Union World Cup.

Steelwork contractor for the project is William Hare.

Presidential visit for Tata Steel

President of The Institution of Structural Engineers, Nick Russell (pictured) has visted Tata Steel's Scunthorpe site to see how a fully integrated steel plant operates and how steel sections are produced.

The visit gave him the opportunity to see the complexities of the steelmaking process that ensures the highest quality structural steel is manufactured at Tata Steel's Scunthorpe site.

A comprehensive visit programme took him through the full steelmaking process from ore blending, blast furnaces, steelmaking, continuous casting and the section mills.

"As structural engineers we always choose the appropriate material for the job. Steel is just one of the materials which engineers work with to create all kinds of structures from houses to high-rise buildings, from car parks to sports stadia and hospitals to bridges," said Mr Russell.

"The versatility of steel construction, in common with other materials, allows complex geometries to be used that satisfy the architectural concept and create landmark designs incorporating large open spaces. This visit has certainly helped deepen my understanding of the steelmaking process and Tata Steel should be proud of the efficiency of its operations."

Richard Lankshear, Tata Steel Marketing Manager, Construction Structures said: "We were delighted to be able to show Nick around our integrated steelmaking site. We believe it is important to show people the measures we put in place to ensure safety on our sites and that our steel is of the highest quality and fit for purpose."

As well as being the 2014 Institution President, Mr Russell is also a Director for Thomasons, one of the country's leading civil and structural engineering consultancies.

Deptford Bridge about to swing into action

Spanning Deptford Creek close to its confluence with the River Thames in south London, a new cable-stayed swing bridge will provide unbroken pedestrian access to the capital's long distance riverside Thames Path when it officially opens this month (November).

Forming part of a Galliard Homes' residential development, the bridge's opening system allows barges to access a ready-mix batching plant located up Deptford Creek.

"The design of the bridge had to incorporate delivering better public access to the river while not interfering with navigation on the Creek," explains David Knight, Senior Engineer at Flint & Neill.

"The best option was a swing bridge fabricated from steel for its lightness which then minimised the size of the M&E equipment."

Including the backspan the bridge is 52m long and predominantly consists of weathering steel plate.

Steelwork contractor S H Structures delivered the bridge deck to site in three main sections and then assembled and welded the structure together in-situ. The steel approach structure was then added and the mast attached to the main deck.

During October the cables were stressed, commissioning began and the resin bonded footbridge surfacing was installed.

NEWS IN BRIEF

A new City of London office tower, 52 Lime Street (dubbed the Scalpel), has been awarded the first-ever **BREEAM** UK New Construction 2014 certificate for sustainable building design. It has also been awarded a BREEAM Excellent rating. Designed by architect Kohn Pedersen Fox, and engineered by Arup the steel-framed tower will be approximately 190m tall, with 35 floors of offices above ground and mezzanine levels, with an additional two basement and two roof plant levels. It is due for completion in 2017.

Lindapter is celebrating its 80th birthday this year. Founded by Bradford engineer Henry Lindsay, the company began by producing a new concept for connecting steelwork and today its clamping systems are used throughout the world.

Border Steelwork Structures has achieved Achilles 'Building Confidence' Level 5 accreditation for its work on the Harraby Community Campus in Cumbria. Main contractor for this project is Laing O'Rourke.

Acecad Software has announced the introduction of an upgrade that allows users of the detailing system SDS/2 (from Design Data) to get StruM.I.S steel fabrication system project information directly from within the SDS/2 system itself. This provides SDS/2 users with critical StruM.I.S data, without having to physically contact the StruM.I.S user.

Barrett Steel said it will make history in November 2014 when it installs a 1500mm diameter tube plasma profiler at its site in Middlesbrough. The RB1500 profiler is the first of its kind to be installed in England and represents a £600,000 investment. The machine will be used for applications within the expanding offshore renewable (wind), oil & gas and construction sectors.

AROUND THE PRESS

Construction News
31 October 2014
McLaren fashions Mayfair build
[Conduit Street/Savile Row] – 'That was the only way you could build this structure [phased and in steel] when the building itself takes up the entire footprint of the site," comments BHC project manager Bobby McCormick.

Construction News
31 October 2014
Cheesegrater's steel megaframe
[Leadenhall Building] – "Some of the plate thicknesses 190mm thick in front elevation nodes also fell outside the remit of existing codes, so we had to agree with Arup a procedure for sampling and testing welds," recalls Severfield project director Alex Harper.

Construction News
31 October 2014
Glasgow branches out
[Silverburn cinema complex] – Steelwork for each theatre had to be acoustically isolated from the main frame and required rubber endplates and washers designed to specific structural and acoustic loads to be included in connection design.

Building Magazine
26 September 2014
Breaking new ground
With a combined steel weight of just 8,000 tonnes or 120kg/m^2, the roof of the Singapore National Stadium is one of the lightest of its kind in the world and is around a third lighter than comparable stadiums around the globe.

Construction News
10 October 2014
Compliance in the supply chain is down to you
[Andy Davies, REIDsteel Production and Quality Manager] – If your scope of work covers more than fabricated steel structure and includes such items as the steel material, bolts, purlins, cladding, decking, stairs, doors and windows, then you need to make sure all of those products are CE marked where a harmonised standard exists.

Temporary steel bridge launched for Crossrail

A 110m-long temporary steel road bridge weighing 350t has been launched over the Great Western Main Line as part of the Crossrail works.

The temporary structure from Mabey Hire (part of the Mabey Group of companies) was installed at Thorney Lane, in Iver, ahead of the demolition of the existing bridge at Christmas.

The bridging system that forms the temporary bridge is a standardised steelwork kit that was assembled on site before being launched into place.

"Once the new bridge is open the temporary structure will be de-launched, dismantled and the kit reused as part of our hire fleet to form another structure," says Chris Carter, Mabey Hire Contracts Director.

Mabey Bridge, one of Mabey Hire's sister companies, fabricates and supplies the steel sections for the bridging system.

Motorway serviced with RoofDek

A new motorway service station on the M5 Southbound in Gloucestershire is being built, after the successful completion of the Northbound service station earlier this year, using over 9,000m^2 of Tata Steel's RoofDek structural decking.

Approximately 6,500m^2 of RoofDek D100 was installed to form the curved roofs of the services two main facility halls.

Both buildings feature green roofs used on top of the RoofDek D100, which was selected for its fast and simple installation and its ability to achieve the required curvature.

The decking configuration having been proved to be structurally suitable with calculations being produced using the free to download RoofDek Analysis software.

On both sides of the motorway the main contractor Buckingham Group also used 3,000m^2 of Tata Steel's RoofDek D60 to form the petrol station canopies.

Tata Steel offers the widest range of structural roof decking manufactured in the UK, with decks ranging from 32mm to 210mm deep, in addition to structural liner trays.

Kelpies gallop to victory in engineering award

The Helix Development in Falkirk, famous for its Kelpie sculptures, has won the Saltire Society 2014 Civil Engineering Award, presented in association with the Institution of Civil Engineers (ICE) Scotland at a special ceremony at the National Museum of Scotland.

Transforming a 300-hectare site from disused scrubland into a modern urban green space, The Helix is completed by Andy Scott's iconic Kelpie sculptures which stand either side of the Forth and Clyde canal.

Since opening in April 2014, The Helix Development has attracted an estimated 500,000 visitors, equivalent to between 3,000 and 4,000 a day.

Commenting on the Civil Engineering Award, Convenor of the Awards Panel, Gordon Pomphrey said: "The Adjudication Panel had no hesitation in recommending The Helix Development for the overall Saltire Civil Engineering Award 2014.

"There is no doubt that the Kelpies have quickly become another iconic must see visitor attraction and will be an internationally recognised landmark for many years to come."

Kelpies designer Andy Scott said: "The inspiration for the original design came from one of the chief engineers at British Waterways, nearly nine years ago. He was quite inspired by the mythological sea horses but I took that in a completely different direction and I wanted to celebrate the heavy horses that were part of Scotland's industrial history."

Established in 1981, the purpose of the awards is to recognise excellence in Civil Engineering in Scotland and has been showcasing the very best in Scottish Civil Engineering for over 30 years.

Network Rail approves FLI's flexi-pile cap

FLI Structures' patented steel flexi-pile cap has now been Form 1 approved by Network Rail for use in its electrification programme.

The product is an innovative solution designed to overcome on-site installation issues. It is claimed the product will help improve the installation productivity rate of driven 610 piles, at site locations where hard ground causes a pile to refuse and where the pile is out of position rotationally.

FLI says the flexi-cap negates the need for time consuming, expensive and quality critical site welding, profiling, testing and painting. It only requires the steel pile to be cut and drilled using a template. A bolted connection completes the site work, so the structure can then be landed onto the foundation helping to improve the installation programme.

Trevor Burden, FLI Engineering Manager said: "The great thing about the Flexi pile cap is that all the quality critical work is done off site, and only quick and simple site works are required, improving safety and quality."

Colorcoat Urban aids this year's best eco home

Cedar House in Somerset, the winner of Build It Awards 'Best Eco Home' 2014 used Tata Steel's Colorcoat Urban® as its roofing system.

According to the design brief, the cladding materials had to be chosen carefully to give Cedar House individuality and be sympathetic to the surroundings. On one side of the house there is an industrial building and on the other sides there are cider orchards.

Tata Steel's Colorcoat Urban® roof system scored highly on all counts and the system helped the owners achieve their brief, providing a home requiring minimal maintenance and with low energy costs.

The Cedar House owners said: 'It was thanks to a great team of suppliers that we were able to create a great home to be very proud of, and we were delighted to receive this prestigious award."

For more information on Cedar House visit www.pointoneone.co.uk

Kaltenbach cuts Zinser machinery deal

Kaltenbach UK has announced a new strategic cooperation with Zinser of Germany to offer its range of oxy-fuel, plasma and fibre laser plate cutting equipment in the UK.

Zinser designs and manufactures a wide range of machines from 1m × 1m oxy-fuel units through to multi-torch systems up to 6m × 12m capacity and beyond, with a combination of both plasma and oxy-fuel burning torches.

Barry Rooney, Kaltenbach UK Managing Director, said: "Zinsers' product range integrates perfectly with that of Kaltenbach and provides our customers with an even greater range of machinery solutions and high quality, leading edge technologies.

"Zinser has the same dedication to quality, customer focus, process capability and service support as Kaltenbach, and with the first order for a new system already received, we are delighted to be able to offer their products into the UK industry".

Diary

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

Thursday 6 November 2014
Embodied Carbon
This webinar will provide practical guidance on how to assess embodied carbon on projects.
For details click here

Tuesday 11 November 2014
Steel Frames and Disproportionate Collapse Rules
This one day course provides a solid introduction in the design of steel-framed buildings to avoid disproportionate collapse. (1 day course) Milton Keynes
For details click here

Tuesday 18 November 2014
Composite Design to EC4 (Part 2)
The second part of this two part webinar will look at Design of Composite Slabs, Scope of EN1994 and technical differences between BS5950 and EN1994
1 hour webinar

Tuesday 2 December 2014
Design of Structural Stainless Steel
1 hour lunchtime webinar free to BCSA and SCI members. This webinar will offer an overview of designing structural stainless steel

Thursday 4 December 2014
Portal Frame Design
This course provide in-depth coverage of the major issues surrounding the analysis, design and detailing of portal frames. Birmingham
For details click here

Tuesday 20 January 2015
Connection Design
1 hour lunchtime webinar free to BCSA and SCI members, offering an overview of connection design.

Tuesday 27 January 2014
Steel Connection Design
This course is for designers and technicians wanting practical tuition in steel connection design. Dublin
For details click here

Broadway's retail connections

How Broadway will sit in Bradford city centre

FACT FILE
Broadway, Bradford
Main client: Westfield Shoppingtowns
Architect: Hadfield Cawkwell Davidson
Main contractor: Westfield
Structural engineer: MPN
Steelwork contractor: Severfield
Steel tonnage: 6,800t

Situated on a 10-acre city centre site, the Broadway Westfield shopping centre is set to make Bradford a major retail destination in Yorkshire. Martin Cooper reports.

Westfield's £275M Broadway scheme in Bradford city centre, which originally stalled in 2008 due to the economic slowdown, is now back in full swing and due to open in time for Christmas 2015.

Of the many retail highlights the development will include two large anchor stores (Debenhams, and Marks and Spencer), car parking for 1,300 vehicles and more than 70 other shops, restaurants and cafes.

"Broadway will become a focal point and enhance the city centre," says Keith Whitmore, Westfield Head of Design & Construction. "It will also act as a springboard for further regeneration of other parts of Bradford and provide a major stimulus for the regional economy by creating direct and indirect jobs across a range of industries."

Work recommenced on site towards the end of last year and as the 8m-deep basement and the piling had previously been completed in 2008, preparatory works were less extensive then they would otherwise have been.

Above ground, the scheme's design had however undergone a value engineering exercise during the intervening years. Structural engineer MPN, who joined the scheme in 2011, and architect Hadfield Cawkwell Davidson, who has been involved since Westfield's original involvement in the scheme in 2006, aided Westfield in this.

Changes to the scheme included reducing the height of the shopping mall from a double level to one level, with single and two-storey shops all accessed from the ground level mall.

Originally a thick post-tensioned insitu transfer slab was designed to span over the turning circle for the service vehicles in the basement and support the multi-storey car park and retail buildings above.

However this was also re-engineered by MPN, on account of the reduced building load of the new scheme, to a conventional steel frame with some large plate girder transfer beams.

In fact, all of the areas of the previous scheme that had originally been designed as a concrete superstructure were converted to steel for the current build, which has contributed to achieving the very tight construction programme on the project. This included many of the project's original slip-formed concrete cores, which were redesigned as steel braced cores.

One and two-storey shops will line the malls

Westfield states the case for steel

"As with many large retail developments, the Broadway scheme has undergone a number of design changes at the request of tenants and some have even taken place during the construction programme," says Keith Whitmore, Westfield Head of Design & Construction. "Steel enables alterations to be made easily and this is why it is ideal for retail projects."

"Most of the alterations have been quite small, such as re-positioning lift and escalator penetrations in the frame, but moving a steel column or two is much easier than altering a concrete wall," adds Mr Whitmore.

Steelwork always contributes to a speedy construction programme and Broadway's entire 6,800t steel frame has been erected in just over 25 weeks. This was aided by Westfield's decision to use only mobile cranes and not to install any tower cranes on this project.

Using mobile cranes also means there are no gaps in the frame – where the tower crane would be sat - that need to be in-filled at a later stage, again allowing a faster steel programme.

The ramp for the main rooftop car park

The scheme will create a new city focal point

Changing the cores' design meant they could be erected along with the project's steel frame, speeding up the programme to such an extent that steelwork contractor Severfield got underway in March and primarily completed the steel erection by early September.

Another reason for the speedy steel construction programme was that the fabrication had begun in 2008.

"We already had more than 2,000t of steel fabricated for the original project and when it stalled we simply stored it away, waiting for the job to resume," says Andy Rae, Severfield Contract Manager. "Once the project restarted we wanted to use as much of this steel as possible so the majority has been re-engineered into the scheme's new design with very little wastage."

As with many city centre construction projects, the logistics of working in and around a confined site as well as how to make deliveries of steel without causing hindrance to neighbouring businesses have been challenging issues for Severfield.

Primarily, Severfield erected the steelwork in a sequential manner, from one side of the site to the other. This allowed other trades to follow on behind and left Severfield with sufficient space in which to store some of its delivered steel.

The exceptions to this methodology were the Debenhams and Marks and Spencer (M&S) anchor stores. Positioned at opposite ends of the scheme, the anchor stores had to be erected first as they typically require a longer fit-out programme than the other smaller retail units.

The majority of the retail zone sits above a service basement, and occupies a footprint that is roughly rectangular in shape. Three main covered malls, with exits positioned along all elevations, form a circuit around the development and link the anchor stores.

The M&S anchor store has two main retail levels plus basement service accommodation, roof level customer collection facilities and plant enclosure. Its structural grid is 8.8m × 8.8m, while the grid for the main shopping mall is slightly smaller at 8m × 8m.

The Debenhams store on the other hand has three retail levels (plus basement, roof level collection facilities and plant) ▶12

Part of the main mall under construction

Flexibility and future proofing

The project's flexibility is aided by the fact that the slip-formed and steel braced cores provide the majority of the steelwork's stability. "What bracing there is had to be located thoughtfully, as it could not go along shop fronts because they are predominantly glazed, while bracing within the retail unit's dividing walls was avoided to provide future flexibility and so allow these walls to be removed should the shop layouts need to change," explains Scott Crawford, MPN Director.

Where bracing was not possible architecturally, for example across the shop front to Marks & Spencer, MPN says it designed a series of moment frames to provide stability to one side of the building. These were erected with the main steel erection.

Three of the blocks at Bradford Broadway had additional capacity built into the frame (including in the fire protection requirements) to allow the future development of two residential buildings and one office building of up to four levels above the retail roof.

These were originally part of the scheme in 2008, but were excluded from the current development due to economic viability. The foundations were already constructed to incorporate these and so it was decided to retain this capacity in the vertical elements of the steel frame.

"Consequently the steelwork in these areas has been designed with larger sections in order to support the future structures," adds Mr Crawford.

◀ 11 and is based around a larger bespoke 10.2m × 12m grid.

"The design of the Debenhams store has gone through a few alterations since the original scheme," explains Mr Rae. "As one of the two anchor stores they decided that they would like an extra floor halfway through the redesign of the project. So all of the steel, which had been premade in 2008 for this part of the job, had to be reworked to accommodate this extra level."

Five levels of car parking are located above the central retail zone and this part of the steel frame utilises a 16m x 8m grid to provide column free car parking bays.

"This is a typical pattern for multi-storey car parks," adds Mr Rae. "And it works well in this scheme as we only had to omit every other column where the structure changes from retail to car parking."

A couple of steel bridges, formed with 16t beams, link car parking on either side of the pedestrianised mall and these constituted some of the heaviest lifts of the entire steel programme.

The car park also incorporates another important redesign as the main spiral access ramp form was changed from a concrete to a steel frame.

MPN says it was able to model the complex geometry, which consisted of several curved sections, all of different radii, using 3D Revit modelling software, and then passed this to Severfield as an IFC file for incorporation into their fabrication model. This was intended to allow the ramp to be constructed earlier in the programme to fast track vehicular access to the roof of the scheme for follow on trades.

The final elements of steel frame erection programme were the installation of a series of portal frames that span the 12m-wide mall and support a glazed roof.

Heart of the city

The Broadway development will complete the 'Connecting the City" project, providing new links to the major quarters of the city centre, including improvements to the existing pedestrianised streets and public realm.

It will be at the heart of the shopping district and connected to the new and highly regarded City Park, the Law Courts and Little Germany/Cathedral Quarter.

"As well as providing a new covered route between city districts we have also ensured the cladding systems for the exterior elevations respect the surroundings," explains Robert Bancroft, architect at Hadfield Cawkwell Davidson. "To this end, Broadway has colonnaded and stone-clad elevations facing the city's historic cathedral (pictured right)."

The scheme will also benefit from a comprehensive public transport network, which includes nearby bus and taxi stands, and two railway stations.

Steelwork nears completion

FACT FILE
Blackburn bus station
Main client: Blackburn and Darwen Council
Architect: Capita
Main contractor: Thomas Barnes
Structural engineer: Capita
Steelwork contractor: EvadX
Steel tonnage: 100t

Feature columns drive bus station project

An exacting erection process was necessary for the installation of six feature columns that form Blackburn's new iconic bus station.

Public transport in and around Blackburn is set to get a huge boost as a new £5M modern state of the art bus station nears completion

Situated in the middle of the town's main shopping district, the facility will replace the existing bus station that has been described as increasingly inadequate.

Kate Hollern, Labour Leader of the local council says the bus station was a key part of the town's regeneration. "It will bring major improvements for bus passengers as well as better transport links."

John Threlfall, Business Director at Lancashire United (the local bus operator) says: "We are delighted as it will be an improvement for passengers to have a warm covered bus station rather than the existing wet and windswept facility."

The structure is approximately 80m-long with an office hub positioned at one end. Conceived as a giant canopy, it has a 5m-high perimeter glazing system that will create a fully enclosed, but light-filled, concourse. Overhead, the bus station will be topped with a partially glazed pitched roof, which will let even more natural light into the building.

Supporting the roof and the glazing system are the most visual and architectural elements of the new facility; six centrally positioned double looped supporting columns. Said by some to resemble cow horns, the columns are 5m high with a maximum distance of 12m between the tips.

Even though the steel columns are located in the middle of the station they still manage to create the architectural vision of an open plan space. Centrally positioned holding down bolts help give the impression of the columns hanging from the roof as opposed to holding the structure up.

Adding to the architectural vision, a series of smaller GRP formed loops, positioned between the steel looped columns, will create a cascading effect to the roof.

"The columns are structurally important as well as being a major aspect of the design as they are moment frames giving the overall structure much of its stability," explains Brendan Cassidy, Capita Design Engineer.

Working on behalf of main contractor Thomas Barnes, steelwork contractor EvadX has completed an unusual programme.

"There were a number of challenges associated with the looped columns," says Andrew Roberts, EvadX Project Manager. "Not just how to fabricate and erect them, but also how we could transport them to site."

EvadX begins the column erection process

"The columns are structurally important as well as being a major aspect of the design as they are moment frames giving the overall structure much of its stability."

The answer was for EvadX to subcontract steel specialist Jamestown Profiling to fabricate the six columns in a specially designed jig (see box).

Once the loops reached site the erection procedure involved first installing the longest part of each column, which included the base plate. Once this was in position, along with a supporting temporary prop, the other piece of the loop column was bolted into place.

"Once we had both pieces bolted and propped and we were sure the second piece was in the correct position the splices were then site welded," adds Mr Roberts.

Each erected column also included a temporary tie positioned along the top for added positional accuracy.

Once all six of the columns were installed, some final adjustments were needed to ensure the columns were correctly aligned.

"The base plates have 16 post-tensioned Macalloy rods set into concrete bases," explains Mr Roberts. "These were tightened after the columns were installed as the final adjustment to make sure the steelwork was rigid."

This then allowed the temporary props to be removed and the rest of the steelwork for the roof to be erected.

The roof steelwork consists of a series of 13m-long horizontal members that link the six columns together on each side, acting as eaves ties.

A further series of smaller box sections, spaced at 800mm centres, then span across the top of the columns, to form the roof structure.

The looped columns are all spaced at 13.5m, except for two at one end where the spacing is a much longer 25m. This wider zone accommodates a steel framed two-storey office hub.

"As it is connected to the canopy roof steelwork the hub columns provide the structure with some added stability," says Mr Cassidy.

Stability for such an unusual building is crucial and the exterior glazing system that is attached to the roof steelwork via brackets provides further stability. "

Lateral load will be transferred from the glazing through the roof steelwork and then down the looped columns," adds Mr Cassidy.

Blackburn's new modern bus station will be fully covered, have 14 stands and feature the latest technology to allow passengers to plan their journeys by bus. It will also be fully manned improving security and providing the travelling public with customer information and ticket purchase facilities. There will also be refreshment and toilet facilities.

Summing up, Andy Smith, Thomas Barnes Contracts Manager says: "This innovative cutting edge design will become a benchmark of quality construction within the town that will help transform the current area into a vibrant modern looking facility. The site has brought up challenges with unknown subways and obstructions being found and removed, and service diversions hindering progress. We look forward to a successful completion.

Blackburn bus station is scheduled to be completed early in the New Year.

Column fabrication

The steelwork used by Jamestown Profiling to produce the 'loop' columns is plated sections with a 410mm wide × 40mm thick top flange and a 480mm wide × 40mm thick bottom flange.

Each column consists of five sections welded together, all of which had been previously bent into the desired shape by a specialist bending company.

"The columns are all very similar, so once we had made a reusable jig we were then able to fabricate each member in fairly rapid succession," says Niall Fortune, Jamestown Profiling Production Manager.

Each fully fabricated column weighs 7.8t, but prior to being delivered to site each member was cut into two pieces to aid transportation. The longest piece was fitted with an internal spigot to aid onsite assembly and both pieces were sent to site with welded plates attached for the final bolted connection.

How the new bus station will look

Steel beats the drum

Feature steelwork is playing a crucial part in the construction of an eye-catching addition to one of Bristol's most historic squares.

FACT FILE
66 Queen Square, Bristol
Main client: Skanska Project Development
Architect: AWW
Main contractor: Skanska
Structural engineer: Skanska Technical Services
Steelwork contractor: William Haley Engineering
Steel tonnage: 75t

In the 18th century Queen Square was one of Bristol's most fashionable addresses. Close to the port and city centre, and built around a large public space adorned with an equestrian statue of King William III, a host of well-heeled Bristolians took up residence here.

Unfortunately, a combination of newer and smarter areas of the city being built in the 19th Century and rash town planning in the 1930s that saw a dual carriageway built diagonally across the square, meant that by the 1960s this part of Bristol was in need of regeneration.

Luckily the city's planners recognised that this was a unique opportunity and decided to restore the square. The offending part of the dual carriageway has long since been closed with traffic diverted to surrounding streets. Buildings, forecourts and railings have been reinstated, while the central open space with its promenades has been restored to its former glory.

The work at Queen Square is on-going and at number 66 an interesting project is underway that combines a retained and renovated Georgian terrace facing the square, with an adjoining new five-storey office block to the rear, both of which will share a spacious entrance and atrium created with structural steelwork.

Dubbed the drum, the entrance/atrium has a reinforced concrete podium with steelwork starting at first floor level to form the upper four floors.

The drum features a curving façade (13m radius) and the steelwork cantilevers out by 3m around this curve. The drum will provide access to the upper floors of the new and retained parts of the project via a staircase, while its predominantly glazed exterior will provide a focal point and bring light into the new building.

The ground floor of the drum will house the building's reception area and the first floor is a circulation space only, supporting a feature staircase. Directly above are the toilet and service areas as well as links to the main office spaces.

The architect's vision for the project was to have an open plan ground floor and a large void behind curtain walling to host the feature staircase.

"To achieve this vision, the ground floor needed to be as column free as possible. No columns are permitted outside the site boundary at ground floor, therefore most of the structural supports are set back about 3m from the front elevation," says Gregorry Garson, Senior Engineer at Skanska.

"Steel offered the lightest solution and the easiest way to form the upper floors," says Andy Bremerkamp, AWW Chartered Architectural Technologist. "Concrete would have been too heavy and the beams would have been far too big."

From the first floor upwards, each entrance to the respective office space is

The steel drum will link the retained and new build parts of the project

formed by the steel frame (drum), which is suspended from a twin roof girder configuration that is held up by two steel columns.

"Due to the floors offset arrangement and the position of the columns at ground floor, a traditional gravity system wasn't feasible," adds Mr Garson. "So the steel solution was developed to ease the connections with the hanger, eliminate creep issues associated with concrete and reduce the weight of the slabs to minimise deflections, which is critical on the glazed perimeter."

Deflections, due to permanent loads are diminished within the steelwork by pre-cambering the roof's girders, as well as the main cantilevering beams at each floor level.

Skanska says the use of a 3D analysis model allowed accurate estimates of the deflections, taking into account the cumulative effect of the weight of each suspended floor on the hanger and the effect on the cantilevers at each floor.

Mr Bremerkamp adds that the use of a BIM model early in the design process helped to speed up and simplify the construction programme.

"The drum is heavily serviced and we had to ensure that all of the cellular beams have their holes in the correct position. Using and sharing the BIM model was the only way of ensuring we had no clashes."

The overall 66 Queen Square project features a number of elements, such as renovating the Georgian terrace and the demolition of two office blocks built in the 1960s and 1980s. Clearing the site enabled the construction of the new office block that connects into the terrace and the drum.

"Apart from some cross bracing and one temporary propping column, the drum is self stable and was consequently one of the first parts of project to be built," explains Ben Yates, Skanska Operations Manager.

"Visually it gave passers-by something to see early on as the concrete frame was just starting as the steel topped out."

For the steel erection programme all of the members were short enough to avoid splicing, and this kept construction as simple and quick as possible.

The beams and columns all had studs welded to them, which allowed them to tie to the reinforced concrete frame of the new build. In the long term, the stability of the entrance will be achieved by a combination of steel bracing and shear walls from the main frame. All the slabs are composite, which also helps to keep weight to a minimum, while also enhancing the environmental credentials of the building.

Steelwork contractor William Haley Engineering will make a return visit to site towards the end of the year to install further steelwork to the top of the new build office block.

Steel, mostly consisting of raking columns will form feature mansards and pitched roofs along two elevations to mimic the adjacent period buildings.

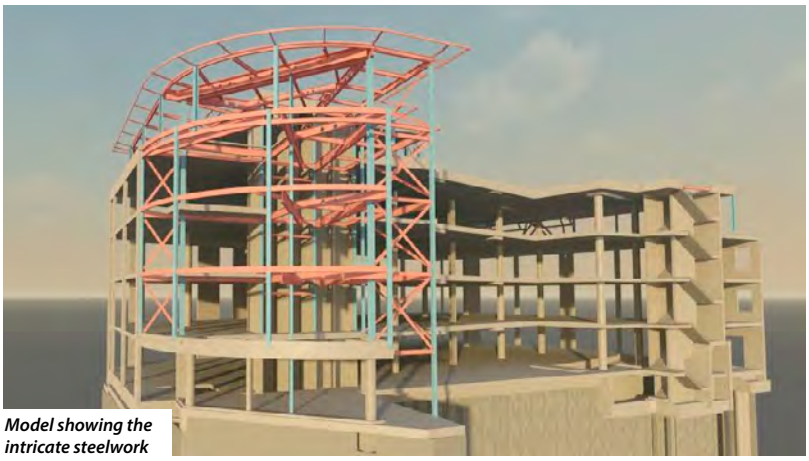
66 Queen Square is due to be completed in June 2015.

Award winning scheme

66 Queen Square has been crowned BIM Project Application Award winner at the annual British Construction Industry awards 2014.

The award was for Skanska's approach of tackling the challenges of blending a part-listed building with a new construction. It is the second year in a row that Skanska has scooped the award, following last year's success with The Woodlands School.

The company said the award winning 2014 entry has seen three key objectives being progressed: 'BIM for free', 'BIM for everyone' and 'Timing is everything'.

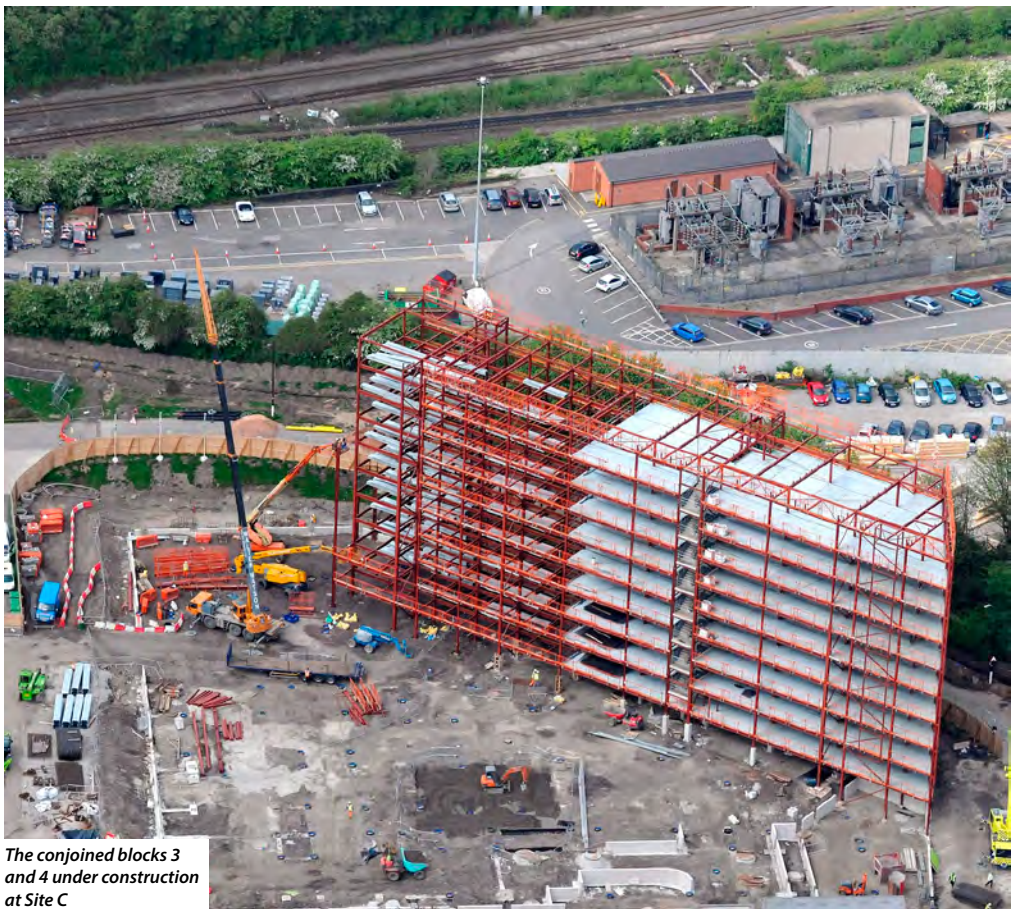


Model showing the intricate steelwork

"Steel offered the lightest solution and the easiest way to form the upper floors."

Residences in steel

Nine steel-framed student accommodation blocks form an integral part of the University of Salford's expansion plans.



The conjoined blocks 3 and 4 under construction at Site C

Speed of construction and efficiency led to steel being chosen

FACT FILE
University of Salford student accommodation
Main client: University of Salford
Architect: Sheppard Robson
Main contractor: Graham Construction
Structural engineer: Cundall
Steelwork contractor: Walter Watson
Steel tonnage: 1,900t

An £84M project for the University of Salford is set to substantially boost its student accommodation offering with the construction of 1,367 bedrooms all featuring en-suite facilities.

Main contractor Graham Construction started work on the project in November 2013 as part of the Salford Villages Consortium, which includes Graham Investment Projects, Campus Living Villages, Equitix and Kier Project Investment, who will jointly invest and develop the property. Project finance has been provided by Standard Life Investments.

The work is taking place on two adjacent plots next to the existing University premises. Known as sites A and C, they will contain five and four residential blocks respectively, varying in size from nine-storeys to five-storeys and all linked by first floor podium decks.

The accommodation blocks are designed to provide sustainable student living with a BREEAM 'Excellent' rating, and include community living with large reception and social spaces – including TV and games room, gym and study lounges, kitchen, launderette and a cinema room.

Gary Holmes, Graham Construction Regional Director believes the project is so prestigious it will raise the company's profile and reputation in the North West. He says: "This is a really significant project with great partners and we look forward to providing an outstanding new facility."

All of the blocks are steel-framed structures and the choice of material was based purely on time and programme benefits.

"We looked at both steel and concrete options for this project and steel was best because it is quicker to erect and more efficient as it helped us design buildings with lots of structural repetition," explains Dan Bradley, Cundall Principal Structural Engineer.

Steelwork's speed of construction was highlighted by the fact that contractor Walter Watson erected the entire steel package in just 16 weeks. The company worked simultaneously on both plots with two gangs each using a 60t capacity mobile crane and two MEWPs with 43m-high reaches.

The site logistics were the main challenges for Walter Watson as both plots are quite confined and so all material installation and erection had to be coordinated and sequenced.

"We had to erect each block sequentially and work our way around the confined and tight plots," explains Trevor Irvine, Walter Watson General Manager Structural Division.

"The podium steelwork was then erected along with each adjoining block which was the only way we could have installed this part of the job as there was no room to get equipment back onto the plots and infill the steelwork later in the programme."

As well as steel erection Walter Watson also coordinated the installation of precast stairs, edge protection and the setting out of the metal decking packs in readiness for

Heights and tonnages

Site A

Block 1	seven storeys	222t
Block 2	five storeys	174t
Block 3	five storeys	141t
Block 4	nine storeys	304t
Block 5	nine storeys	278t
Podium deck		120t

Site C

Block 1	seven storeys	171t
Block 2	five storeys	128t
Block 3	nine storeys	246t
Block 4	nine-storeys	261t
Podium deck		98t

their installation.

All of the accommodation blocks have been designed the same with each one getting its structural stability from bracing, either located in partition walls or in lift and stair cores.

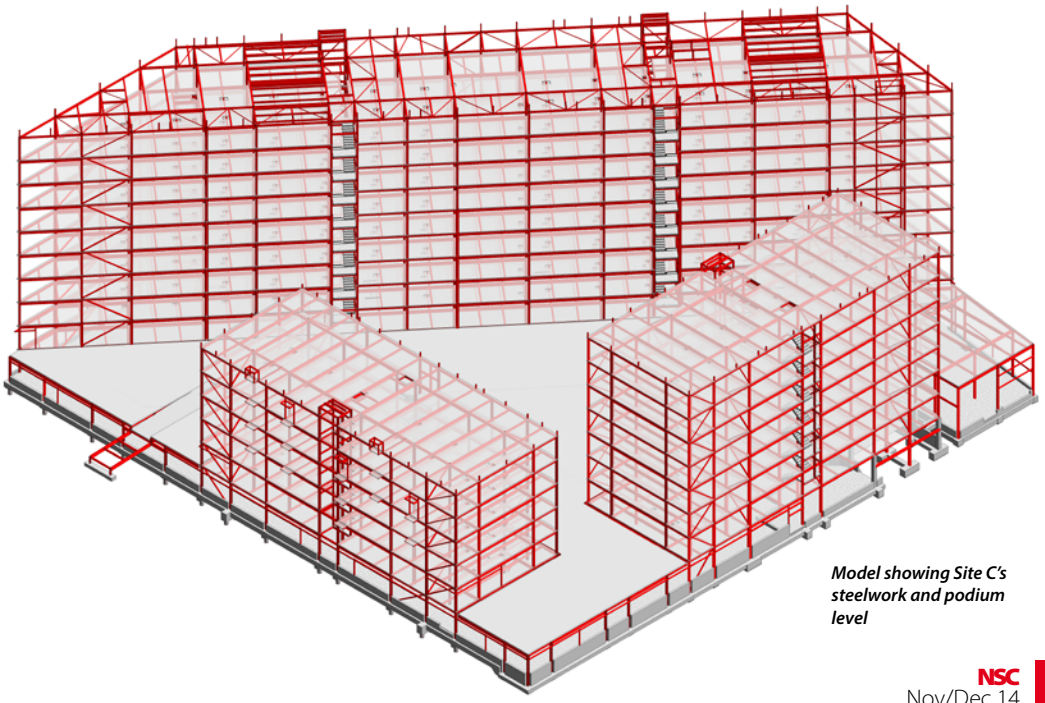
The steelwork is based around common grid patterns of both 8m x 7.8m, and 8m x 5.2m throughout the buildings.

"Repeating these grids all the way up each building was very efficient as it allowed us to accommodate car parking in the below ground levels and then all of the accommodation units above," says Mr Bradley. "This meant no transfer structures were required at ground level where ordinarily the grid may have been expected to change."

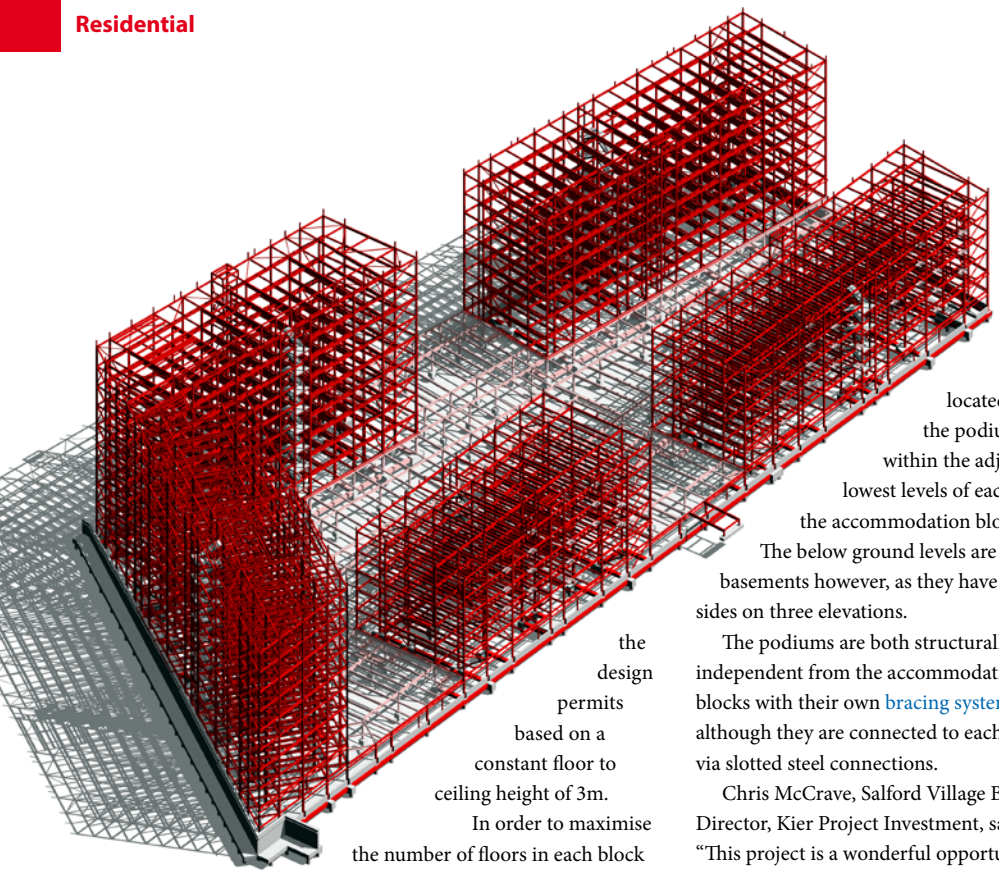
Not having to erect transfer structures not only kept the overall steel tonnage down and consequently helped save the client money, it also had an important bearing on the project's design.

The project is subject to an overall height restriction and nine storeys is the maximum

"Repeating these grids all the way up each building was very efficient as it allowed us to accommodate car parking in the below ground levels and then all of the accommodation units above"



Model showing Site C's steelwork and podium level



Site A's steelwork

the design permits based on a constant floor to ceiling height of 3m.

In order to maximise the number of floors in each block the floor beams have been designed compositely with metal decking and a slim concrete topping.

"If we'd have added transfer structures to one floor it would have added approximately one metre to the overall height and as we couldn't build upwards we would have had to dig the below ground levels deeper and this was not an option," adds Mr Bradley.

The site was formerly an industrial zone and this has left behind land that is still contaminated below a certain depth. Excavating and disposing of any overburden from this site is expensive and so further digging out was not an option.

Site A is the larger of the two plots, containing five blocks all linked by a centrally positioned steel podium deck. Site C is similar in configuration, but with four blocks grouped around another podium.

Car parking as well as plant areas are located below the podiums and within the adjacent lowest levels of each of the accommodation blocks. The below ground levels are not basements however, as they have open sides on three elevations.

The podiums are both structurally independent from the accommodation blocks with their own bracing systems, although they are connected to each building via slotted steel connections.

Chris McCrave, Salford Village Board Director, Kier Project Investment, says: "This project is a wonderful opportunity to provide a fantastic living environment for the students of the University of Salford in the 21st Century. The design ethos of the scheme, with the centralised green space, will provide a hugely interactive 'village' feel."

Summing up Michael Graham, Graham Construction Executive Chairman adds: "This is a significant development and our design and construction teams have done a fantastic job in ensuring that the development is on schedule and within budget. Working alongside our project partners, we have demonstrated that a collaborative approach can work wonders. The site is really taking shape now and will deliver an outstanding new facility to the University of Salford when it is completed next year."

The accommodation blocks are expected to be completed in time for the 2015 autumn term.

Site A takes shape

Accommodating steel

Mark Lawson (SCI)

Steel frames with composite floors and light steel infill walls are widely used in residential buildings of all types because of their excellent acoustic insulation properties and speed of construction. In this project, the column grid was chosen to be compatible with the efficient use of car parking on the below ground levels, and the same grid was extended into the residential levels, which saved on a heavy transfer structure.

The overall depth of the composite floor construction can be minimised by using UKC sections as beams, so that the structural zone of the beam and slab acting compositely is less than 400 mm. This is very important in residential buildings where a floor to floor height of 2.85m is often the norm. Beams can be aligned with separating walls and hidden by them. A further advantage in terms of the whole life design is that the room layout may be reconfigured in the future by moving internal light steel walls, without modifying the basic structure.

Acoustic tests on composite floors show that with a suitable resilient covering, airborne sound reductions are at least 5 dB better than required by the Building Regulations Part E.

Fire resistance is provided by the reinforcement in the composite slabs, and plasterboard ceiling/ encasement of the beams and columns.

In student residential projects, speed of construction is the key to their success as often the construction programme is compressed to less than a year. Steel framed construction can save significant time compared to reinforced concrete, and gives greater reliability that ambitious timescales can be achieved. It is rare these days to see a student residential project that is not in steel, be it structural steel plus infill walls, light steel framing or modular construction.

For more information on steel in residential projects see http://www.steelconstruction.info/Residential_and_mixed-use_buildings

Taking the gamble out of your tender selection

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

The answer is to rely on the British Constructional Steelwork Association (BCSA) or The Register of Qualified Steelwork Contractors Scheme for Bridgeworks (RQSC), as experienced assessors have visited the companies and assessed their competence based on track record, personnel and resources.

There is no easier way of prequalifying companies than using the membership list of the BCSA or RQSC.

Select a steelwork contractor who has the skills to suit your project.

Ensuring steelwork contractors are competent, capable and qualified

BCSA | RQSC The Register of Qualified Steelwork Contractors Scheme | SSIP

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Email: postroom@steelconstruction.org • Website: www.steelconstruction.org

Big is best for logistics centre

A large multi-spanned logistics centre has fully utilised steel's numerous attributes.

FACT FILE
Travis Perkins Group logistics centre, Warrington
Main client: Travis Perkins Group
Architect: Chetwoods
Main contractor: Sir Robert McAlpine
Structural engineer: Curtins Consulting
Steelwork contractor: Caunton Engineering
Steel tonnage: 2,100t

Located on the outskirts of Warrington the Omega scheme is a 30-year regeneration project with some 100,000m² of logistics development already under construction or completed.

Miller Developments, in partnership with KUC Properties are developers for this £1bn scheme that will create thousands of jobs on site. The partnership, known as Omega Warrington, has recently gained outline planning consent for further manufacturing and logistics space that will almost double the size of the current development.

On Omega North, a new 65,032m² regional logistics centre is being built for the Travis Perkins Group, said to be the UK's largest supplier to the building and construction market. The new £35M centre will supply the company's wholesale and retail outlets across the region, supporting around 450 jobs on site.

As with the vast majority of distribution and logistics centres, this is a steel-framed structure and one that required steelwork contractor Caunton Engineering, working on behalf of main contractor Sir Robert McAlpine, to erect 2,100t of steel during an eight-week programme.

Steelwork was erected using three 50t capacity mobile cranes, eight MEWPs, two telehandlers for loading materials and a total of 13 erecting personnel.

Caunton's erection team had a firm cement/lime stabilised platform to work off of as the main contractor had previously undertaken a ground improvements programme as well as installing the pad foundations.

The footprint of the building measures 350m x 160m and the structure consists of 10 portal frames each with a 35m span at 8m centres. To form the building's multi-arched roof, each portal features purlins set on a radius along 533mm × 210mm segmented rafters that are spliced at third points.

The rafters are connected to 16m high 356mm × 368mm internal columns, with 610mm × 228mm columns used on the building's perimeters to fulfill the design requirements. Additional stability for this huge structure is obtained from bracing located around the perimeter elevations - avoiding windows and loading doors - and more triangular bracing in the roof.

"Designing the bracing for the walls was a challenge as there are a lot of openings which had to be avoided. However there were no such restrictions in the roof and we were able to put as much bracing there as necessary," says Pete Clayton, Caunton Engineering Contracts Manager.

Working from one end of the main 350m-long elevation, Caunton erected the steel frame portal by portal. However, due to the phased handover sequence required by the client, a considerable amount of temporary bracing was needed to allow cladding to commence before the frame was completed.

Once the main frame was up Caunton had to erect attached office blocks and unloading dock canopies to the front and back elevations.

"Both of the two-storey office blocks are compositely designed as large lean-to's getting all of their stability from the adjoining warehouse," says Mr Clayton.

The front elevation's office block is 60m-long and will house the building's main administrative departments, while the 30m-long back elevation offices will accommodate goods-in and staffrooms.

Another external feature of the structure are the two 100m-long dock canopies that were also retrofitted to the steel frame. The canopies are 21m wide and propped with a column every 35m, to correspond with the frame's grid pattern.

Geoff Cooper, Travis Perkins Group Chief Executive says: "This is an exciting time for the entire group. We are growing our already extensive product portfolio, and our new logistics centre in Warrington will enhance our offering by improving the supply of products to our branch network."

The Travis Perkins Group logistics centre is scheduled to be operational by early 2015.

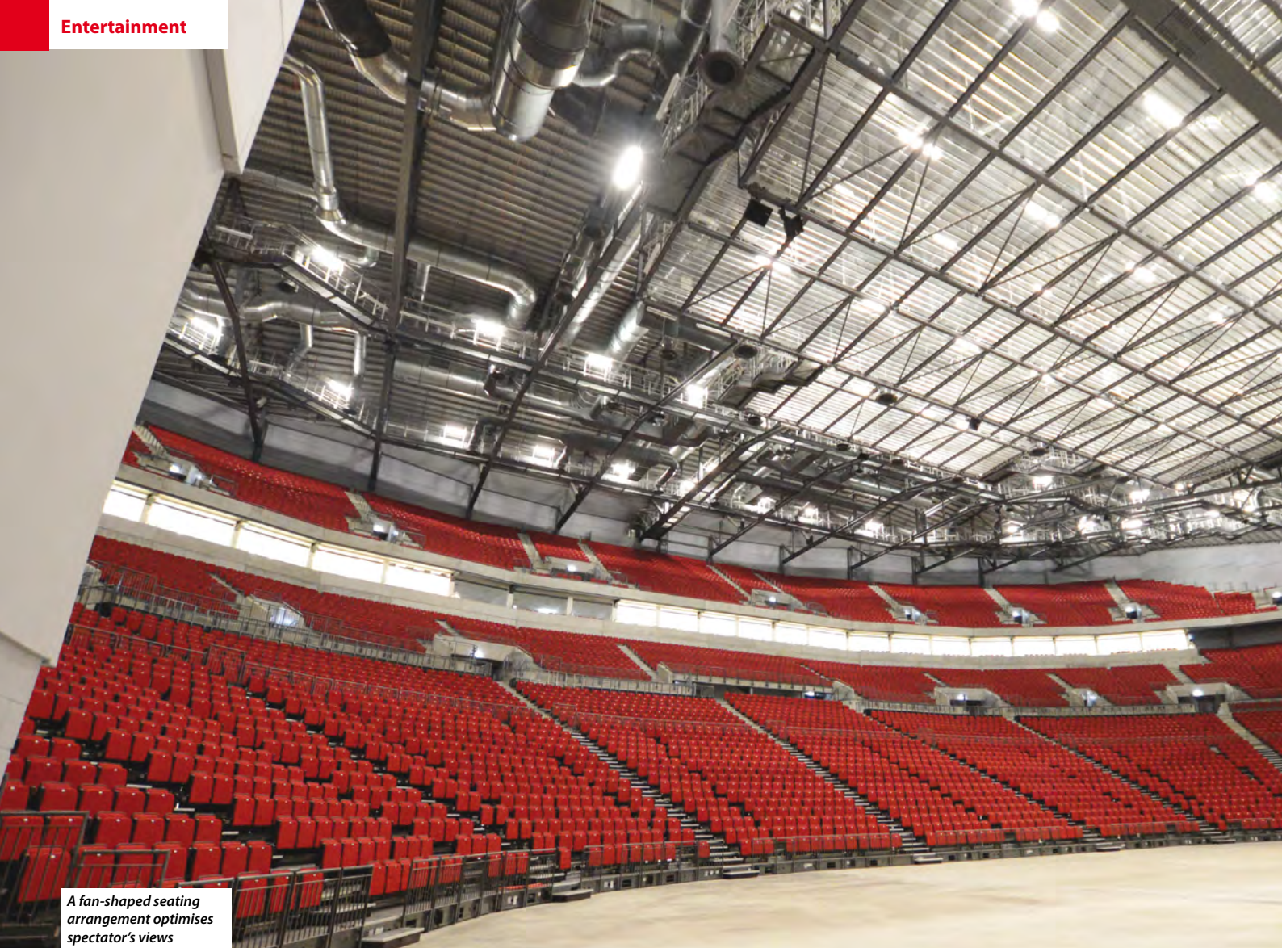
"Designing the bracing for the walls was a challenge as there are a lot of openings which had to be avoided. However there were no such restrictions in the roof and we were able to put as much bracing there as necessary."

Ten portal frames form the logistics centre

Caunton erects steelwork using its fleet of MEWPs

Temporary bracing in place between the portals

Visualisation of the finished building



A fan-shaped seating arrangement optimises spectator's views

Arena underpins regeneration

In the latest of our Projects Revisted series, Martin Cooper reports from the First Direct Arena in Leeds, a project that has gained a BREEAM 'Very Good' score of 63%, the highest for any UK arena.

FACT FILE
First Direct Arena, Leeds
Main client: Leeds City Council
Architect: Populous
Main contractor: BAM Construction
Structural engineer: Arup
Steelwork Contractor: Severfield
Steel tonnage: 4,200t

Since opening in August 2013 with a concert from Bruce Springsteen, the 13,500 capacity First Direct Arena has quickly established itself as one of the leading venues in the north of England, not just for music, but also for comedy and sports events (see NSC March 2012).

Economic and environmental issues have also taken centre stage with this project as the venue is now underpinning a part of Leeds city centre that was previously in need of some attention.

The Arena has helped stimulate local regeneration with a number of businesses, such as restaurants and a hotel, opening up in response to the venue. A social benefit of the project was that it helped create jobs during the construction phase, while plenty of local people have now found employment at the completed arena.

Creating such an important and iconic venue required the right framing material. Steel construction played a leading role, as a large indoor space with spans of up to 72m needed a steelwork solution.

"Entertainment venues need large column free spaces and steel offers the best and most cost effective method of achieving these requirements," explains Gordon Alexander, BAM Construction Manager.

"During the early stages of the design process we compared all materials and we chose steel as it not only gave us the long spans but also easily accommodated the extremely heavy loadings within the roof," adds John Rhodes, Lead Architect for the project (now Director at HOK Sport).

Forming the auditorium are a total of 13 trusses spanning up to 72m, five of which span onto a 54m-long truss over the stage.

Innovation and collaboration with the acoustician and the rest of the supply chain enabled an increase in truss depth, thereby minimising the weight of these large elements despite the required heavy acoustic roof.

According to structural engineer Arup, the top roof layer bears onto the trusses via resilient bearings and this prevents sound escaping while maximising structural efficiency.

Aside from its innovative design (see box), the First Direct Arena fulfils many aspirations made clear during the initial planning stages.

Photo © Ben Brown

Earlier this year the First Direct Arena beat off stiff global competition to win the prestigious New Venue of the Year title at the Stadium Business Awards in London. It was also the winner of the Sports and Leisure Structures category at the Institution of Structural Engineers 2013 awards, and a finalist at this year's Structural Steel Design Awards.

Innovative arena for city centre

The site's shape and location required the UK's first fan-shaped bowl, overlooking a stage set into the slope of the site. This innovation ensured the desired capacity was achieved and helped unlock the commercial potential of the city centre arena.

Planning conditions limiting noise breakout to 10dB below background levels dictated the structural form of the roof and façade. 'BIM coordination was used to solve the complex geometry," says Jim Bell, Arup Project Director.

"A 4D BIM model was used for construction sequencing, enabling visual illustration of residual risks, like lifting the PA steel truss. The 75-hour continuous operation to fix the 180t truss involved two 500t cranes lifting and holding the steelwork in position while the permanent restraints were installed."

BAM has measured the benefits of BIM as saving 1,000 design coordination issues and £350 to £500k in site costs against typical expectations on a similar project.

"The council had asked people in Leeds what they wanted and a venue was the overwhelming response," says Mr Rhodes. "Leeds City Council then implemented delivering the project economically, while also adhering to an important sustainability agenda."

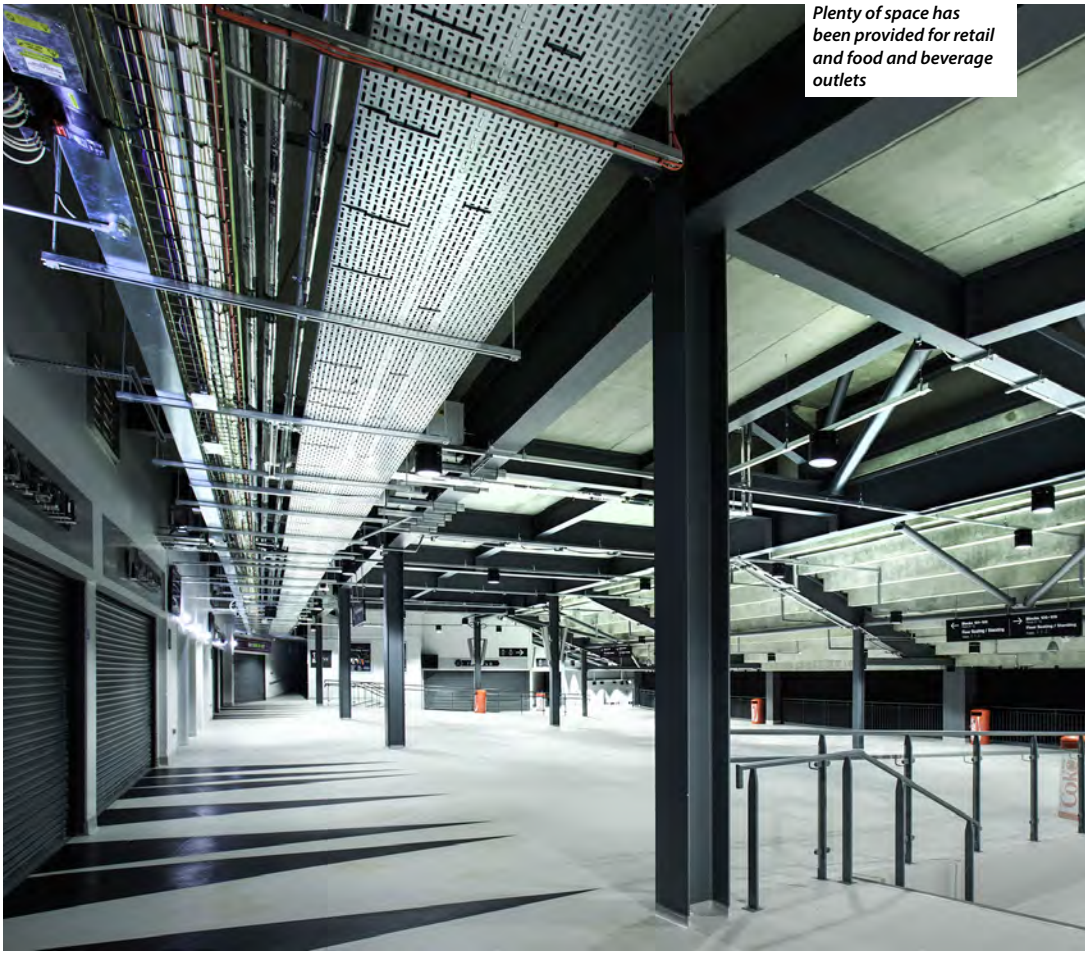
Unfortunately the timing of the project's commencement coincided with the economic recession and this made achieving the sustainability targets very challenging.

"Sustainability was a key priority for the council as we wanted to achieve the highest BREEAM rating of any UK venue," says Chris Coulson, Leeds City Council's Project Manager.

"This is the council's approach to all of its developments, however due to the recession achieving our aims was a little more difficult, but we overcame this through value engineering, choosing the right materials and teamwork."

All of the project team's hard work and its persistence in adhering to a sustainability agenda has paid dividends as artists and the public alike have showered the venue with plaudits over the last year.

Rod Stewart is claimed to have said that the arena has the best acoustics of any venue he has appeared at on this side of the Atlantic. High praise indeed!



Plenty of space has been provided for retail and food and beverage outlets

Strengthening existing steelwork

Dorota Koschmidder-Hatch of SCI describes the general principles of strengthening existing steel sections.

Strengthening implies the addition of structural material in order to achieve adequate stability, member resistance or stiffness. This may be achieved by adding material to increase load carrying capacity, stiffening the member or introducing additional restraint to the original section thereby increasing its overall resistance by reducing susceptibility to buckling.

The reuse of existing buildings contributes to the sustainable goals established by the UK government and strengthening techniques are fundamental to achieving this. In the light of the adoption of the Sustainable Construction Strategy it is preferable to refurbish an existing building rather than construct a new one. Adaptation of an existing structure saves the embodied energy of the structural elements, hence it is no surprise that BREEAM recognises the benefit of refurbishment as one of its building credits.

After the need for strengthening a structure is identified, the first step is to establish the intervention strategy, as described in Reference [1]. Alterations to historic buildings will need to address heritage concerns in line with the policies of relevant authorities (English Heritage in England). The general principles to be followed are the need to preserve as much original construction as possible, use of traditional materials and techniques and ensuring that the intervention is reversible as much as practically achievable. Where work is conducted in a building in use, the strategy needs to make allowance for user comfort and minimise disruption, for example in a working hospital limits on vibration and construction noise should be in place.

It is essential that adequate stability and resistance are maintained during the temporary stage when the unaltered structure is subject to actions at the time of strengthening and when the modified structure is subject to actions at the final design configuration. It may be necessary to relieve an existing section of some of its stress by propping or jacking before adding new elements. Care must be taken that such jacking does not overload the structure below.

New elements may be added to assist an existing one in resisting design actions. In such a case, some form of jacking and load transfer will be required. The designer needs to be aware that in some instances the addition of a new member changes the structural behaviour of the whole system. For example, introducing a tie to an unbraced arch leads to significant changes in stress distribution.

In a case where the new element provides a 'safety factor' to a ductile structure, it is necessary to provide a tight fit between the new and existing members. This ensures any 'overload' is transferred to the strengthening member.

There is also the option of supplementing the existing section with a new member, which allows retention of the original member without alteration and without risk of overloading. This approach is particularly useful in historic structures, as the process may be reversed, if necessary.

Examples of strengthening

A common means of strengthening steel beams or columns is bolting on new steel sections (see Figure 1). If load sharing is required, it may be necessary to jack or prop the existing member and use preloaded bolts to avoid slip under loading. For old steel the use of spreader washers may be justified to avoid crushing when the bolts are tensioned.

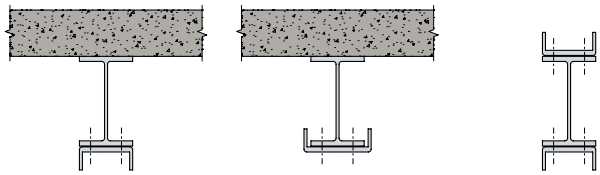


Figure 1: Strengthening of existing members by bolting on new sections

Welding may also be used if the original material is weldable. A wide variety of steel sections such as plates, angles or bars may be added to the basic section profile (see Figure 2). Design of connections should allow flat or downhand welding as the work will involve welding on site. Propping may be required if the strengthening element is intended to take over some of the existing stress from the reinforced member via composite action. When a strengthening plate is expected to take a significant amount of stress, it may be worth continuing the reinforcement over the full length of the member. This approach eliminates the need to consider load transfer into the strengthening plate at its ends.

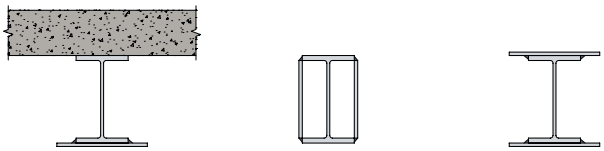


Figure 2: Strengthening of existing members with the use of welding

Where a grossly understrength beam needs to be retained, another beam may be inserted below or above it if possible. preloaded bolts or welding may be used to ensure that composite action between the new and existing elements is achieved. Duplication of members is another way of relieving an understrength structure. For example, where for each existing beam a new parallel one is added, the loading on the existing beams is halved. This approach is suitable for historic structures, as it does not disturb the existing fabric, but it is difficult to achieve unobtrusively.

Strengthening a steel beam may also be achieved by adding shear connectors and providing either a new concrete slab or a new topping over an existing slab of weak concrete, as shown in Figure 3. In the latter case the existing concrete becomes permanent formwork for the new composite topping. If the

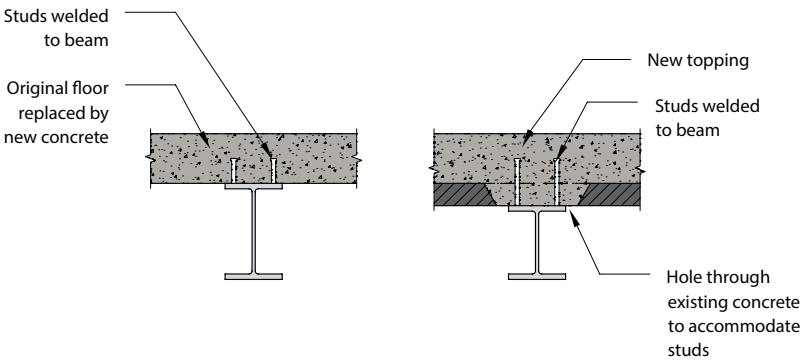


Figure 3: Steel beam strengthened by the introduction of composite action with the new concrete

steel is weldable, shear connectors can be welded to the beam, otherwise they could take the form of bolts introduced through the flanges, see Figure 4.

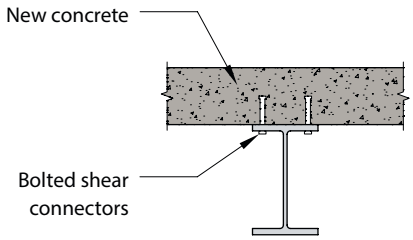


Figure 4: Bolts used as shear connectors

Concrete encasement is a popular strengthening or stiffening technique, when there are no objections to the original member being concealed. Concrete cover of at least 75 mm is recommended to provide room for reinforcement and adequate space for concrete to flow around the member. Good compaction of concrete is essential and may call for the use of external vibrators. Concrete encasement is also a means of providing fire protection to steel members. An example of concrete encasement is shown in Figure 5.

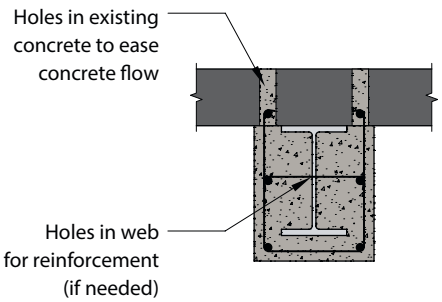


Figure 5: Example of a beam encased in concrete

Strengthening hollow sections may be achieved by internal filling. This approach requires the introduction of openings for injection of concrete or grout and for the expulsion of air.

Connection methods

Methods for providing new connections and enhancing existing ones are considered here in the context of enhancing strength, stiffness or stability of existing structures.

The use of bolts is particularly convenient for site connections and where the connection is provided to an element made of non-weldable steel. Preloaded bolts can be used in joints where slip needs to be avoided, as described earlier. Alternatively, bolts in tight tolerance holes may be used where surface treatment required for preloaded bolt connection is not practical to achieve.

Many factors determine the success or failure of welding. Chemical composition, mechanical properties and the metallography of the original metal combined with the appropriate choice of welding parameters and procedure all influence the outcome of welding. 'Weldability' must always be tested.

Welding of stressed members requires additional careful consideration. Heat effects may cause loss of strength leading to yielding or buckling, therefore safety precautions must be in place. The use of clamped-on steel blocks acting as heat sinks may be implemented. Alternatively the welded member may be propped.

Designers need to bear in mind the practical limitations of welding on site, fire risk and the need to provide a controlled environment. Detailed design should call for vertical or downhand fillet welding, as they provide the simplest combination and are most likely to result in sound welds. Inspection and testing of welds is especially important in repair and strengthening work. If a suitable bolted connection is possible, welding is not normally preferred according to SCI [2]. Specialist advice on feasibility, welding materials, procedures and testing should be sought. SCI publication Guide to Site Welding [3] offers additional information on the subject.

The use of structural adhesives as an alternative method of joining structural elements is becoming more common. Bonded connections are typically achieved with the use of epoxy resin between steel or reinforced concrete beams or slabs and steel plates. This method provides a flexible form of strengthening where complicated connections are required and no additional heat or residual stress is introduced to elements joined. Adhesives are highly sensitive to elevated temperatures, their structural properties deteriorate over time and the lack of codified guidance for calculating structural resistance is a hindrance. The aerospace and marine industries have embraced the use of adhesive joints; performance data and structural properties are mentioned in Reference [4].

Conclusion

In a world where the drive towards lowering our carbon footprint is pushed by legislation, repair and strengthening are encouraged over demolition and building anew. In these circumstances developing knowledge of strengthening techniques for existing structures is a necessary step.

References

1. M Bussel, Appraisal of Existing Iron and Steel Structures, SCI, 1997
2. Design for Construction, SCI, 1997
3. P Craddock, Guide to Site Welding, SCI, 2002
4. S A Hashim, Adhesive bonding of thick steel adherends for marine structures, Marine Structures, volume 12, issue 6, 1999

Resistance of beams and columns in fire: Worked examples to the Eurocodes (P403)

Resistance of members at elevated temperature (in fire conditions) is a key component of structural design. The Eurocodes describe how resistances may be calculated, including simple methods which are readily applied to common structural forms.

SCI has published new design guidance in P403 covering the resistance of beams and columns in Fire. This publication presents two numerical worked examples demonstrating the calculation of the critical temperature and resistance at elevated temperature. The examples cover both unprotected and protected solutions, using the simple calculation methods given in the Eurocodes.

The first example is a two-storey structure with non-composite beams and a modest minimum fire resistance period of 30 minutes. The resistance of unprotected and protected members is demonstrated, along with the resistance of a beam-to column bolted end plate connection.

The second example is a seven storey structure with composite beams and a more onerous minimum fire resistance period of 90 minutes. Protected solutions are expected for this longer resistance period. This example demonstrates the calculation of the resistance of a composite beam, utilising NCCI.

The calculation process for both examples is facilitated by two on-line design tools, available from www.steelconstruction.info

To purchase this publication go to the SCI Shop http://shop.steel-sci.com

Full Price £50

(BCSA and SCI Member price £25)

Catalogue number	**SCI P403**
ISBN Number	978-1-85942-212-0
Author	SCI
Pagination	76pp
Pages	A4
Publication date	2014

A complimentary publication, Fire resistance design of steel framed buildings (P375), is also available.

AD 384
Welding in cold-formed zones

This AD note provides guidance/clarification related to the issue of welding in the cold-formed zones of structural hollow sections.

For historical reasons, there are concerns regarding the possible strain ageing caused by welding and hence the reduction in impact toughness in the corners of rectangular hollow sections (RHS). Consequently, EN 1993-1-8 [(1)] includes restrictions on welding in the corner area (Clause 4.14 and Table 4.2). These restrictions do not apply if heat-treatment has been performed on cold-formed sections, to produce sections with compatible metallurgical properties to hot finished sections (EN 10210 [(2)]).

Cold-formed RHS according to EN 10219 [(3)] do not automatically satisfy the requirement of Table 4.2 of EN 1993-1-8, for welding in the corners. The internal corner radius "r" in Table 4.2 is more stringent than EN 10219.

However, EN 10219 hollow sections satisfying the EN 1993-1-8 criteria for welding in cold-formed corners are available on the European market. These materials can be welded without concerns regarding the possible reduction in impact toughness of hollow section corners.

Thus, if the conditions in Table 4.2 of EN 1993-1-8 are met, which is the case for some EN 10219 product, welding in the corners and adjacent cold-formed zones is automatically permitted.

For other EN 10219 product which does not meet the geometric conditions in Table 4.2, but satisfies the chemical analysis given in the table, welding in the corners and adjacent cold-formed zones is also permitted.

In other cases, welding in this area is only allowed if it can be shown by tests that welding can be permitted for that particular application.

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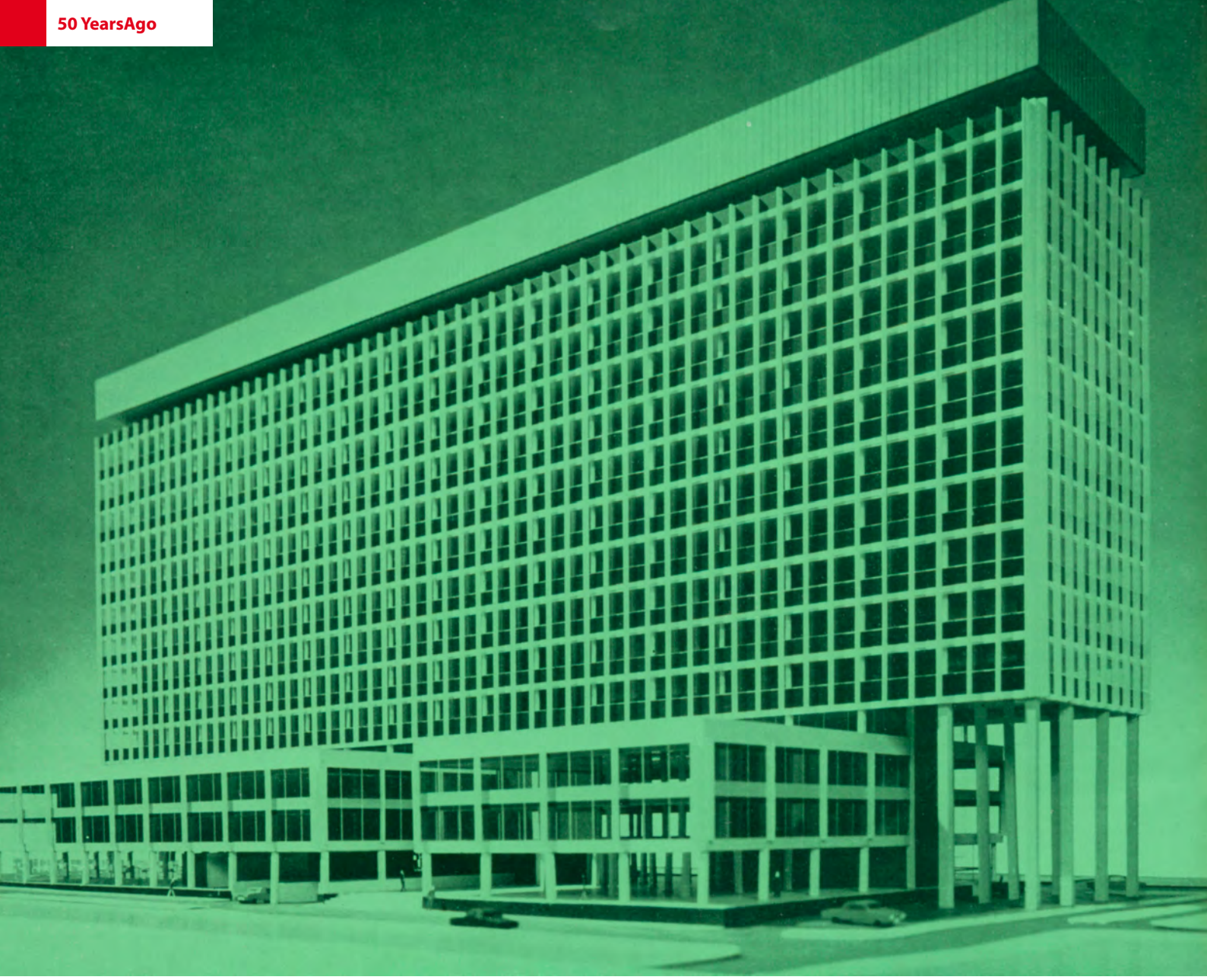
Tel: **01344 636525**
Email: **advisory@steel-sci.com**

References:

(1) BS EN 1993-1-8:2005 Eurocode 3: Design of steel structures. Design of joints (incorporating corrigenda December 2005, September 2006, July 2009 and August 2010)

(2) BS EN 10210-1:2006 Hot finished structural hollow sections of non-alloy and fine grain steels. Technical delivery conditions (2006)
BS EN 10210-2:2006 Hot finished structural hollow sections of non-alloy and fine grain steels. Tolerances, dimensions and sectional properties (2006)

(3) BS EN 10219-1:2006 Cold formed welded structural hollow sections of non-alloy and fine grain steels. Technical delivery conditions (2006)
BS EN 10219-2:2006 Cold formed welded structural hollow sections of non-alloy and fine grain steels. Tolerances, dimensions and sectional properties (2006)



Britain's largest Structure in High-Yield Stress Steel

FROM BUILDING WITH STEEL MAY 1964

Two features of particular interest are to be found in the 18-storey office building at present under construction in Liverpool for Littlewoods Mail Order Stores Ltd. It is the largest structure in Britain to use to any great extend high-yield stress steel to BS 968: 1962 (about 1,500 tons) and to utilise rigid welded steel frame construction.

When completed, the four storey podium will occupy an area of 400 ft by 136 ft and the 400 ft by 70 ft tower will be more than 200 ft high from ground level. The work is being done in two stages, the first of which represents approximately 60 per cent of the building and utilises in the region of 2,200 tons of steelwork: two thirds of this is high stress steel.

During the planning studies a very interesting fact emerged. It was found that the cost of a structural frame in welded high-yield steel, including fireproofing and the precast concrete slabs was in the region of 14/4d per square foot, where as the closest estimate for any alternative method of construction was about 14/7d per square foot. Other advantages of the steel frame of particular note are (1) that the structure has minimum bulk and thus leaves more internal space available and (2) it allows maximum freedom in internal architectural planning.

Steelwork Data

As mentioned earlier, the framing is designed on a fully rigid basis, the main frames being fabricated in high-yield stress steel to BS 968:1962 with full strength site welded joints at each floor level. Secondary steelwork is of mild steel with wind connections using high-strength friction grip bolts.

The main frames are built across the building, running north-south, at 22-ft centres. They are designed as individual frames to resist wind pressure and all vertical loads, analysis being carried out by computer at the Manchester college

of Technology after approximating the sections required. As a matter of interest the following data is given. The maximum vertical dead plus imposed load on one column is 1,150 tons with a maximum wind thrust of plus and minus 68 tons. The maximum moment at steel base level from wind plus vertical load effects is 190 ft. tons.

The frames for the 70-ft wide tower have four stanchions at 22-ft centres. The podium has an additional 11-ft bay at the southern side of the building and a further three bays of 22 ft, 22 ft and 11 ft to the north. The secondary steelwork consists of floor beams at 11 ft centres spanning between the main frames.

A typical high-yield stress steel frame for the tower comprises external stanchions with 14 in by 16 in UC sections of various weights up to sixth-floor level, followed by 14 in by 14½ in UCs to the twelfth floor and a 12 by 12 in UC to the 14th floor. The internal columns are of 14 in by 16 in UC sections of various weights up to the twelfth floor, surmounted by a 14 in by 14½ in UC to the fourteenth floor. Above the fourteenth floor the building sets in and the frames are supported on 24 in by 12 in by 160-lb UBs spanning the full width of the frames below.

The floor beams are UBs of three serial sizes, 21 in by 8¼ in, 18 in by 7½ in and 16 in by 7 in, the weights of the beams being varied according to the loads and moments carried.

At the east and west ends, where the tower oversails the podium, the tower supports are all-welded high-yield stress steel box columns extending from foundations to the fourth floor. These stanchions each consist of two 18 in by 1½ and two 33 in by 1 in plates welded together to form a 36 in by 18 in box and are free standing from the ground floor, i.e. for 50 ft of their length. A special built-up stiffener unit, shaped in the form of a universal column section and welded into the top of the box stanchion, is used to facilitate connection of the next length of stanchion above.

Site welding

Great care has been taken to ensure welded joints of great quality. For instance, before any site welding was carried out, all welders were tested at the works of the steelwork contractors. During construction, site welds were tested, as required by the consulting engineers, by non-destructive methods.

Fire Protection

Regarding fire protection, the stanchions to basement and ground floor in the car parking areas are encased in concrete to give four hours protection, and the beams in those areas have lightweight preformed casings to give the same fire grading. The framework to lift and staircase cores is also encased in concrete. In other cases the steelwork is clad throughout in lightweight preformed casings giving a fire grading of two hours.

Floors

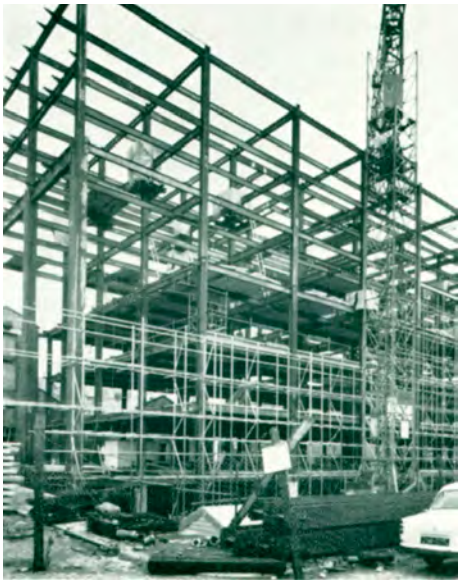
The building is enclosed by curtain walling supported from cantilevered floor panels, completely free of the structural framework. The floor units consist of precast concrete slabs 7 ft 4 in wide by 11 ft long by 5½ in thick. These floor panels were lifted into position by the steelwork contractors' tower cranes. It was found that by this method, not only could full use be made of the cranes but, by co-relating the steelwork erection programme with the floor panel deliveries, economies were made and additional safety given to the welders who always had a floor within normal ladder access.

Littlewoods Department of Architecture and Planning is responsible for the architectural work for this project and Bingham Blades & Partners are the consulting engineers.

View showing welded beam-to-column joint

Column prepared for site welding

Lower floor units in position during erection



Steelwork contractors for buildings

Membership of BCSA is open to any Steelwork Contractor who has a fabrication facility within the United Kingdom or Republic of Ireland. Details of BCSA membership and services can be obtained from
Gillian Mitchell MBE, Deputy Director General, BCSA, 4 Whitehall Court, London SW1A 2ES
Tel: 020 7747 8121 Email: *gillian.mitchell@steelconstruction.org*

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

- **C** Heavy industrial platework for plant structures, bunkers, hoppers, silos etc
- **D** High rise buildings (offices etc over 15 storeys)
- **E** Large span portals (over 30m)
- **F** Medium/small span portals (up to 30m) and low rise buildings (up to 4 storeys)
- **G** Medium rise buildings (from 5 to 15 storeys)
- **H** Large span trusswork (over 20m)
- **J** Tubular steelwork where tubular construction forms a major part of the structure
- **K** Towers and masts
- **L** Architectural steelwork for staircases, balconies, canopies etc
- **M** Frames for machinery, supports for plant and conveyors
- **N** Large grandstands and stadia (over 5000 persons)
- **Q** Specialist fabrication services (eg bending, cellular/castellated beams, plate girders)
- **R** Refurbishment
- **S** Lighter fabrications including fire escapes, ladders and catwalks
- **FPC** Factory Production Control certification to BS EN 1090-1
  - **1** – Execution Class 1
  - **2** – Execution Class 2
  - **3** – Execution Class 3
  - **4** – Execution Class 4
- **QM** Quality management certification to ISO 9001
- **SCM** Steel Construction Sustainability Charter
  (● = Gold, ● = Silver, ● = Member)

Notes

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

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

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	SCM	Guide Contract Value (1)
A C Bacon Engineering Ltd	01953 850611			●	●		●										2		Up to £2,000,000
A & J Stead Ltd	01653 693742			●	●					●	●			●	●		2		Up to £100,000
Access Design & Engineering	01642 245151				●	●			●	●	●			●	●	✔	2		Up to £4,000,000
Adey Steel Ltd	01509 556677				●	●	●	●		●	●			●	●	✔	3	●	Up to £2,000,000
Adstone Construction Ltd	01905 794561			●	●	●	●									✔	2	●	Up to £3,000,000
Advanced Fabrications Poyle Ltd	01753 653617				●	●	●	●	●	●	●				●		2		Up to £800,000
AJ Engineering & Construction Services Ltd	01309 671919			●	●					●	●			●	●	✔	4		Up to £1,400,000
AKD Contracts Ltd	01322 312203				●					●	●			●	●		2		Up to £100,000
Angle Ring Company Ltd	0121 557 7241												●			✔	4		Up to £1,400,000
Apex Steel Structures Ltd	01268 660828			●	●	●	●			●	●			●			2		Up to £1,400,000
Arminhall Engineering Ltd	01799 524510	●			●					●	●			●	●	✔	2		Up to £400,000
Arromax Structures Ltd	01623 747466	●		●	●	●	●	●	●	●	●	●		●	●		2		Up to £800,000
ASA Steel Structures Ltd	01782 566366			●	●	●	●			●	●			●	●	✔	2		Up to £800,000
ASD Westok Ltd	0113 205 5270												●			✔	4		Up to £6,000,000
ASME Engineering Ltd	020 8966 7150				●	●				●	●			●	●	✔	2	●	Up to £1,400,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●	●	●				●			●	●	✔	2		Up to £1,400,000
Austin-Divall Fabrications Ltd	01903 721950			●	●		●	●		●	●			●	●	✔	2		Up to £800,000
B D Structures Ltd	01942 817770			●	●	●	●				●	●		●		✔	2		Up to £800,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●				✔	4		Up to £1,400,000
Barnshaw Section Benders Ltd	01902 880848												●			✔	4		Up to £800,000
BHC Ltd	01555 840006	●	●	●	●	●	●	●			●	●		●	●	✔	4		Above £6,000,000
Billington Structures Ltd	01226 340666		●	●	●	●	●	●	●	●	●	●		●		✔	4	●	Above £6,000,000
Border Steelwork Structures Ltd	01228 548744			●	●	●	●			●	●				●		2		Up to £3,000,000
Bourne Construction Engineering Ltd	01202 746666		●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	●	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●		●	●	●	●	●	●	●	●			●	●	✔	4		Up to £3,000,000
Builders Beams Ltd	01227 863770				●					●				●	●	✔	2		Up to £1,400,000
Cairnhill Structures Ltd	01236 449393	●			●	●	●	●	●	●				●	●	✔	4	●	Up to £3,000,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●		●	●	●		●	●	✔	4	●	Up to £6,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	●	●	●		●		✔	4	●	Above £6,000,000*
CMF Ltd	020 8844 0940				●		●	●		●	●				●	✔	2		Up to £6,000,000
Cook Fabrications Ltd	01303 893011				●					●	●			●	●		2		Up to £800,000
Coventry Construction Ltd	024 7646 4484			●	●	●	●		●	●	●			●	●	✔	2		Up to £800,000
D H Structures Ltd	01785 246269			●	●		●				●			●			2		Up to £100,000
Discain Project Services Ltd	01604 787276				●					●	●				●	✔	2		Up to £1,400,000
Duggan Steel Ltd	00 353 29 70072		●	●	●	●	●	●			●					✔	4		Up to £4,000,000
ECS Engineering Services Ltd	01773 860001	●		●	●	●	●	●	●	●	●			●	●	✔	3		Up to £2,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●		✔	4	●	Up to £6,000,000
EvadX Ltd	01745 336413			●	●	●	●	●	●	●	●	●				✔	2	●	Up to £3,000,000
Four Bay Structures Ltd	01603 758141			●	●					●	●			●	●		2		Up to £1,400,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●		✔	2		Up to £800,000
Gregg & Patterson (Engineers) Ltd	028 9061 8131			●	●	●	●	●				●		●		✔	3		Up to £2,000,000
H Young Structures Ltd	01953 601881			●	●	●	●	●			●			●	●	✔	2		Up to £2,000,000
Had Fab Ltd	01875 611711				●				●	●	●				●	✔	4		Up to £3,000,000
Hambleton Steel Ltd	01748 810598		●	●	●	●	●	●				●		●		✔	4	●	Up to £2,000,000
Harry Marsh (Engineers) Ltd	0191 510 9797			●	●	●	●				●	●			●	✔	2		Up to £1,400,000
Henry Smith (Constructional Engineers) Ltd	01606 592121			●	●	●	●	●								✔	3		Up to £2,000,000
Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	SCM	Guide Contract Value (1)

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	SCM	Guide Contract Value (1)
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●	✔	2		Up to £3,000,000
Intersteels Ltd	01322 337766				●	●	●	●					●			✔	3		Up to £2,000,000
J & A Plant Ltd	01942 713511				●	●									●		2		Up to £200,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●					●		●			4		Up to £6,000,000*
John Reid & Sons (Strucsteel) Ltd	01202 483333		●	●	●	●	●	●	●	●	●	●		●	●	✔	4		Up to £6,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445			●	●	●	●	●	●	●	●	●		●	●	✔	4	●	Up to £3,000,000
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●					✔	2	●	Up to £4,000,000
Legge Steel (Fabrications) Ltd	01592 205320			●	●		●		●	●	●			●	●		2		Up to £400,000
Luxtrade Ltd	01902 353182									●	●				●	✔	2		Up to £800,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●				●	✔	4		Up to £3,000,000
M J Patch Structures Ltd	01275 333431				●					●	●			●		✔	2		Up to £800,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●		2		Up to £1,400,000
Mabey Bridge Ltd	01291 623801	●	●	●	●	●	●	●	●	●	●	●	●	●		✔	4	●	Above £6,000,000
Mackay Steelwork & Cladding Ltd	01862 843910			●	●		●			●	●			●	●	✔	4		Up to £800,000
Maldon Marine Ltd	01621 859000				●	●		●	●	●					●	✔	3		Up to £1,400,000
Mifflin Construction Ltd	01568 613311		●	●	●	●	●				●						2		Up to £3,000,000
Murphy International Ltd	00 353 45 431384	●			●		●				●				●	✔	4		Up to £1,400,000
Newbridge Engineering Ltd	01429 866722	●		●	●	●	●				●				●	✔	3		Up to £1,400,000
Nusteel Structures Ltd	01303 268112						●	●	●	●						✔	4		Up to £4,000,000
Overdale Construction Services Ltd	01656 729229			●	●		●	●			●				●		2		Up to £400,000
Painter Brothers Ltd	01432 374400								●		●				●	✔	2	●	Up to £6,000,000
Pencro Structural Engineering Ltd	028 9335 2886			●	●	●	●	●	●		●			●	●	✔	2		Up to £2,000,000
Peter Marshall (Steel Stairs) Ltd	0113 307 6730									●					●	✔	2		Up to £800,000*
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●	✔	2		Up to £1,400,000
R S Engineering SW Ltd	01579 383131				●					●	●			●	●	✔	2		Up to £100,000
Rippin Ltd	01383 518610			●	●	●	●	●						●	●		2		Up to £1,400,000
S H Structures Ltd	01977 681931						●	●	●	●		●				✔	4	●	Up to £3,000,000
SDM Fabrication Ltd	01354 660895	●	●	●	●	●	●				●			●	●	✔	4		Up to £800,000
Severfield plc	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✔	4	●	Above £6,000,000
Shaun Hodgson Engineering Ltd	01553 766499	●			●		●			●	●			●	●	✔	3		Up to £800,000
Shipley Structures Ltd	01400 251480			●	●	●	●		●	●	●			●	●		2		Up to £1,400,000
Snashall Steel Fabrications Ltd	01300 345588			●	●	●	●	●			●				●		2		Up to £1,400,000
South Durham Structures Ltd	01388 777350			●	●	●				●	●	●			●		2		Up to £800,000
Southern Fabrications (Sussex) Ltd	01243 649000				●					●	●			●	●	✔	2		Up to £800,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●				●			●	●	✔	2		Up to £200,000
Traditional Structures Ltd	01922 414172		●	●	●	●	●	●	●		●	●		●	●	✔	2	●	Up to £2,000,000
TSI Structures Ltd	01603 720031			●	●	●	●										2		Up to £1,400,000
Tubecon	01226 345261						●	●	●	●				●	●	✔	4	●	Above £6,000,000*
W & H Steel & Roofing Systems Ltd	00 353 56 444 1855			●	●	●	●	●						●	●		4		Up to £2,000,000
W I G Engineering Ltd	01869 320515				●					●					●	✔	2		Up to £200,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✔	2		Up to £6,000,000
Westbury Park Engineering Ltd	01373 825500	●			●		●	●	●	●	●				●	✔	4		Up to £800,000
William Haley Engineering Ltd	01278 760591			●	●	●			●	●	●					✔	4	●	Up to £2,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●		●		✔	4	●	Above £6,000,000
Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	FPC	SCM	Guide Contract Value (1)

Corporate Members

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

Company name	Tel
Balfour Beatty Utility Solutions Ltd	01332 661491
Bluefing Group	020 3040 6723
Griffiths & Armour	0151 236 5656
Highways Agency	08457 504030
Kier Construction Ltd	01767 640111

Company name	Tel
PTS (TQM) Ltd	01785 250706
Roger Pope Associates	01752 263636
Sandberg LLP	020 7565 7000
SUM Ltd	0113 242 7390
Welding Quality Management Services Ltd	00 353 87 295 5335

Associate Members

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

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

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

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

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM
AceCad Software Ltd	01332 545800		●								N/A	
Albion Sections Ltd	0121 553 1877	●									M	
Andrews Fasteners Ltd	0113 246 9992									●	M	
Arcelor Mittal Distribution - Scunthorpe	01724 810810								●		D/I	
ASD metal services	0113 254 0711								●		D/I	
Ayrshire Metal Products (Daventry) Ltd	01327 300990	●									M	
BAPP Group Ltd	01226 383824									●	M	
Barrett Steel Services Limited	01274 682281								●		D/I	
Behringer Ltd	01296 668259					●						

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM
BW Industries Ltd	01262 400088	●									M	
Cellbeam Ltd	01937 840600	●									M	
Cellshield Ltd	01937 840600							●			N/A	
Cleveland Steel & Tubes Ltd	01845 577789								●		M	
CMC (UK) Ltd	029 2089 5260								●		D/I	
Composite Profiles UK Ltd	01202 659237	●									D/I	
Cooper & Turner Ltd	0114 256 0057									●	M	
CSC (UK) Ltd	0113 239 3000		●								N/A	
Cutmaster Machines (UK) Ltd	01226 707865					●					N/A	

Steelwork contractors for bridgeworks

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

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

FG Footbridge and sign gantries
PG Bridges made principally from plate girders
TW Bridges made principally from trusswork
BA Bridges with stiffened complex platework (eg in decks, box girders or arch boxes)
CM Cable-supported bridges (eg cable-stayed or suspension) and other major structures (eg 100 metre span)
MB Moving bridges
RF Bridge refurbishment
AS Ancilliary structures in steel associated with bridges, footbridges or sign gantries (eg grillages, purpose-made temporary works)
QM Quality management certification to ISO 9001
FPC Factory Production Control certification to BS EN 1090-1
1 – Execution Class 1 2 – Execution Class 2
3 – Execution Class 3 4 – Execution Class 4
SCM Steel Construction Sustainability Charter (● = Gold, ● = Silver, ● = Member)

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

BCSA steelwork contractor member	Tel	FG	PG	TW	BA	CM	MB	RF	AS	QM	FPC	NHSS 19A	NHSS 20	SCM	Guide Contract Value (1)
Briton Fabricators Ltd	0115 963 2901	●	●	●	●	●	●	●	●	✓	4		✓		Up to £3,000,000
Cairnhill Structures Ltd	01236 449393	●	●	●	●			●	●	✓	4			●	Up to £3,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	✓	4	✓	✓	●	Above £6,000,000*
Four-Tees Engineers Ltd	01489 885899	●	●	●	●		●	●	●	✓	3		✓	●	Up to £2,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445		●		●			●	●	✓	4			●	Up to £3,000,000
Mabey Bridge Ltd	01291 623801	●	●	●	●	●	●	●	●	✓	4	✓	✓	●	Above £6,000,000
Millar Callaghan Engineering Services Ltd	01294 217711	●						●	●	✓	4				Up to £800,000
Murphy International Ltd	00 353 45 431384	●	●	●					●	✓	4				Up to £1,400,000
Nusteel Structures Ltd	01303 268112	●	●	●	●	●	●	●	●	✓	4	✓	✓		Up to £4,000,000
Painter Brothers Ltd	01432 374400	●		●					●	✓	2			●	Up to £6,000,000
S H Structures Ltd	01977 681931	●		●	●	●	●		●	✓	4		✓	●	Up to £3,000,000
Severfield (UK) Ltd	01204 699999	●	●	●	●	●	●	●	●	✓	4		✓	●	Above £6,000,000
Non-BCSA member															
Allerton Steel Ltd	01609 774471	●	●	●	●				●	✓	4		✓		Up to £2,000,000
Centregreat Engineering Ltd	029 2046 5683	●	●	●	●		●	●	●	✓	4				Up to £400,000
Cimolai SpA	01223 350876	●	●	●	●	●	●	●	●	✓	4				Above £6,000,000
Concrete & Timber Services Ltd	01484 606416	●	●	●	●	●	●		●	✓	4			●	Up to £800,000
Donyal Engineering Ltd	01207 270909	●						●	●	✓	3		✓	●	Up to £1,400,000
Francis & Lewis International Ltd	01452 722200							●	●	✓	2		✓	●	Up to £2,000,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456	●	●	●	●	●		●	●	✓	3				Up to £2,000,000
Hollandia BV	00 31 180 540540	●	●	●	●	●	●	●	●	✓	3				Above £6,000,000
IHC Engineering (UK) Ltd	01773 861734	●							●	✓	3		✓		Up to £400,000
Interserve Construction Ltd	0121 344 4888							●	●	✓	N/A				Above £6,000,000*
Interserve Construction Ltd	020 8311 5500	●	●	●	●		●	●	●	✓	N/A				Above £6,000,000*
Lanarkshire Welding Company Ltd	01698 264271	●	●	●	●	●	●	●	●	✓	4	✓		●	Up to £2,000,000
P C Richardson & Co (Middlesbrough) Ltd	01642 714791	●						●	●	✓	N/A				Up to £3,000,000

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM
Daver Steels Ltd	0114 261 1999	●									M	
Duggan Profiles & Steel Service Centre Ltd	00 353 56 7722485	●							●		M	
easi-edge Ltd	01777 870901							●			N/A	●
Fabsec Ltd	0845 094 2530	●									N/A	
FabTrol Systems UK Ltd	01274 590865		●								N/A	
Ficep (UK) Ltd	01942 223530					●					N/A	
FLI Structures	01452 722200	●									M	●
Forward Protective Coatings Ltd	01623 748323						●				N/A	
Goodwin Steel Castings Ltd	01782 220000	●									N/A	
Graitec UK Ltd	0844 543 8888		●								N/A	
Hadley Group Ltd	0121 555 1342	●									M	○
Hempel UK Ltd	01633 874024						●				N/A	
Highland Metals Ltd	01343 548855						●				N/A	
Hilti (GB) Ltd	0800 886100									●	M	
Hi-Span Ltd	01953 603081	●									M	
International Paint Ltd	0191 469 6111						●				N/A	●
Jack Tighe Ltd	01302 880360						●				N/A	
Jamestown Cladding & Profiling Ltd	00 353 45 434288	●									M	
John Parker & Sons Ltd	01227 783200								●	●	D/I	
Joseph Ash Galvanizing	01246 854650						●				N/A	
Jotun Paints (Europe) Ltd	01724 400000						●				N/A	
Kaltenbach Ltd	01234 213201					●					N/A	
Kingspan Structural Products	01944 712000	●									M	●

Company name	Tel	1	2	3	4	5	6	7	8	9	CE	SCM
Lindapter International	01274 521444									●	M	
MSW Structural Floor Systems	0115 946 2316	●									D/I	
Murray Plate Group Ltd	0161 866 0266								●		D/I	
National Tube Stockholders Ltd	01845 577440								●		D/I	
Peddinghaus Corporation UK Ltd	01952 200377					●					N/A	
PPG Performance Coatings UK Ltd	01773 814520						●				N/A	
Prodeck-Fixing Ltd	01278 780586	●									D/I	
Rainham Steel Co Ltd	01708 522311								●		D/I	
Sherwin-Williams Protective & Marine Coatings	01204 521771						●				M	○
Sika Ltd	01707 384444						●				M	
Structural Metal Decks Ltd	01202 718898	●									M	●
Tata Steel	01724 404040				●						M	
Tata Steel Distribution UK & Ireland	01902 484000								●		D/I	
Tata Steel Ireland Service Centre	028 9266 0747								●		D/I	
Tata Steel Service Centre Dublin	00 353 1 405 0300								●		D/I	
Tata Steel Tubes	01536 402121				●						M	
Tata Steel UK Panels & Profiles	0845 3088330	●									M	
Tekla (UK) Ltd	0113 307 1200		●								N/A	
Tension Control Bolts Ltd	01948 667700						●			●	M	
voestalpine Metsec plc	0121 601 6000	●									M	●
Wedge Group Galvanizing Ltd	01909 486384						●				N/A	
Yamazaki Mazak UK Ltd	01905 755755					●					N/A	

New and revised codes & standards

From BSI Update October 2014

CORRIGENDA TO BRITISH STANDARDS

BS EN 1994-1-2:2005+A1:2014
Eurocode 4. Design of composite steel and concrete structures. General rules. Structural fire design
CORRIGENDUM 2

BS EN ISO 14555:2014
Welding. Arc stud welding of metallic materials
CORRIGENDUM 1

UPDATED BRITISH STANDARDS

PD 6688-1-7:2009+A1:2014
Recommendations for the design of structures to BS EN 1991-1-7
AMENDMENT 1

BRITISH STANDARDS PROPOSED FOR CONFIRMATION

BS 5493:1977
Code of practice for protective coating of iron and steel structures against corrosion

BRITISH STANDARDS REVIEWED AND CONFIRMED

BS EN 287-6:2010
Qualification test of welders. Fusion welding. Cast iron

BS EN 1011-8:2004
Welding. Recommendations for welding of metallic materials. Welding of cast irons

BS EN 10283:2010
Corrosion resistant steel castings

BRITISH STANDARDS UNDER REVIEW

BS EN 10318:2005
Determination of thickness and chemical composition of zinc- and aluminium-based metallic coatings. Routine method.

BS EN ISO 14171:2010
Welding consumables. Solid wire electrodes, tubular cored electrodes and electrode/flux combinations for submerged arc welding of non alloy and fine grain steels. Classification

BS EN ISO 14341:2011
Welding consumables. Wire electrodes and weld deposits for gas shielded metal arc welding of non alloy and fine grain steels. Classification

BS EN ISO 14344:2010
Welding consumables. Procurement of filler materials and fluxes

BS EN ISO 15792-1:2008+A1:2011
Welding consumables. Test methods. Test methods for all-weld metal test specimens in steel, nickel and nickel alloys

BS EN ISO 15792-2:2008
Welding consumables. Test methods. Preparation of single-run and two-run technique test specimens in steel

BS EN ISO 17633:2010
Welding consumables. Tubular cored electrodes and rods for gas shielded and non-gas shielded metal arc welding of stainless and heat-resisting steels. Classification

NEW WORK STARTED

ISO 3575
Continuous hot-dip zinc-coated and zinc-iron alloy-coated carbon steel sheet of commercial and drawing qualities
Will supersede BS ISO 3575:2011

ISO 6930-2
High yield strength steel plates and wide flats for cold forming. Delivery condition for normalized, normalized rolled and as-rolled steels

ISO 13976
Hot-rolled steel sheet in coils of structural quality and heavy thickness
Will supersede BS ISO 13976:2005

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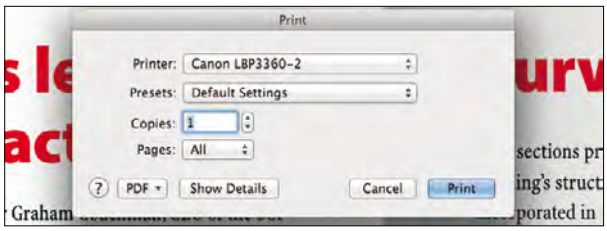

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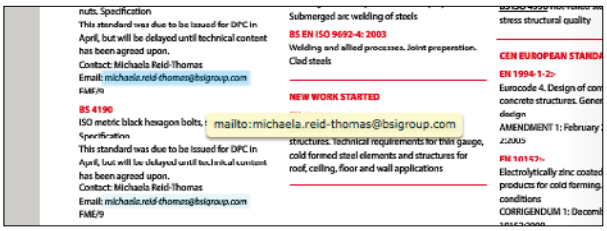

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