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NSC

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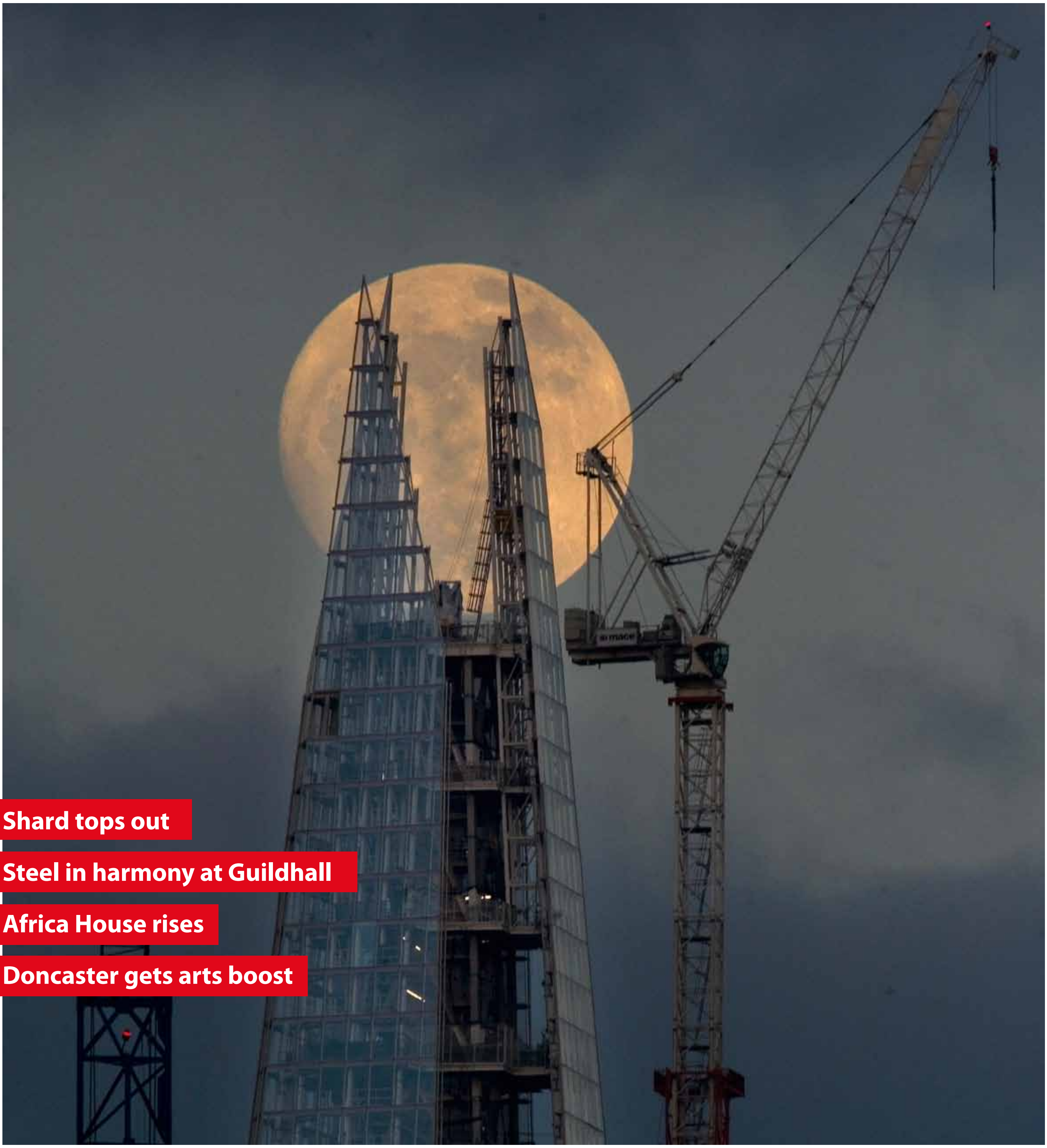
May 2012 Vol 20 No. 5



Shard tops out

Steel in harmony at Guildhall

Africa House rises

Doncaster gets arts boost

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

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

Each issue of NSC is typically 44 pages and contains five pages of news, developments related to Eurocodes, cutting edge project reports from site, and the latest technical updates from the Steel Construction Institute in its Advisory Desk Note series. Popular features are 50 Years Ago and 20 Years Ago, looking at key projects of the past by revisiting the pages of 'Building With Steel' and 'Steel Construction'.

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Cover Image
The Shard, London
Client: Sellar Property Group
Architect: Renzo Piano
Steelwork contractor: Severfield-Reeve Structures
Steel tonnage: 13,000t

BCSA

TATA STEEL

SCI Steel Knowledge

May 2012 Vol 20 No 5

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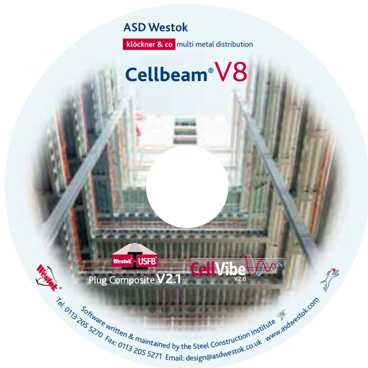

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Steel wins carbon comparison

Nick Barrett - Editor

We reported last month on research showing that steel frames still dominate the market for multi storey and single storey buildings; this month we report on new research showing some of the reasons for steel's continuing dominance, and suggesting why its market share is likely to grow.

The latest in the Cost Comparison Study series, which has just been published, shows once again that steel remains the most cost effective way to build modern offices, as well as being increasingly obviously the superior option when sustainability is important – which is of course always.

The study (see News) demonstrates the cost advantages obtainable by selecting steel – on average five per cent lower than concrete options, but there is a saving of up to nine per cent for the frame and upper floors when considered alone. Construction programmes are significantly shortened using steel, by 13% for the three storey office and 11% for an eight storey city centre office building. As well as the frames and floors themselves being cheaper, selecting a steel frame also provides savings from smaller foundations, lightweight roofs, lower storey heights, reduced cladding costs and smaller preliminaries costs.

What is new with this year's study is the embodied carbon calculation, which showed that steel is convincingly superior to post tensioned concrete on this score as well. The overall study was carried out by quantity surveyor Gardiner & Theobald (G&T), consultant Peter Brett Associates (PBA) and contractor Mace. Cost information for each alternative was provided by G&T, with buildability, logistics and programming input coming from Mace and PBA designing the frames.

The study used designs of buildings of a type typical of those actually being commissioned in today's market, and was very extensive, with four designs developed for the out of town building and two for the eight storey building.

PBA also carried out an embodied carbon assessment on the eight storey office building. This involved a cradle-to-grave assessment for carbon dioxide emissions, which included the carbon involved in producing the frame and constructing the building as well as considering what happens to the materials when the building is decommissioned. The recent Target Zero low carbon building design guidance project informed the calculation for steel emissions and published Concrete Centre data was used for the concrete calculations.

The difference between the two is striking. The steel building had embodied carbon content 23% less than concrete. Even allowing for the use of 30% fly ash and granulated blast furnace slag in the concrete mix rather than the standard Ordinary Portland Cement, which might be best practice but is not always what actually happens, meant steel still had some 11% less embodied carbon. Using steel piles for both options added to the foundation costs of both, but delivered a quicker substructure construction programme in return.

The steel sector has for long confidently argued that steel delivers an excellent sustainability performance, and the Cost Comparison Study is further proof of that case.

NSC

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Higher sustainability costs less says report

A new report based on research by quantity surveyor Gardiner & Theobald, consultant Peter Brett Associates (PBA) and contractor Mace shows higher sustainability being achieved on steel framed buildings than concrete alternatives. The steel frames' sustainability benefits such as lower embodied carbon are also being delivered at a lower cost than alternatives.

The report, the latest in the Cost Comparison Study series commissioned by the BCSA and Tata Steel, shows the cost and lower embodied carbon benefits of steel being delivered on two typical modern office blocks – a three storey business park office building, Building 1, and an eight storey city centre office, Building 2.

The frames were designed by PBA, with cost information for each option from G&T with Mace considering buildability, logistics and programme. PBA also carried out an embodied carbon assessment for Building 2.

The report shows that the total building cost for the steel options are on average 5% lower than the concrete options because of lower floor and frame costs, smaller foundations, lightweight roofs, lower storey heights, reduced cladding costs and reduced preliminaries costs.

The steel framed options were up to 9% lower than for concrete when the frame and upper floors alone were considered. Construction programmes for steel framed solutions were 13% shorter compared with concrete framed buildings for the three storey office, and 11% shorter for the eight storey city centre office.

The city centre office cellular steel option also had an 18-30% lower embodied carbon total than the post tensioned band beam option.

"To benchmark steel against alternative materials on cost and sustainability, we commission construction experts to design real buildings as they would for any client," says Alan Todd, Tata Steel Construction General Manager.

"We look at the frame individually and also the whole building as a steel frame generates a cost and carbon saving for other elements, such as foundations and cladding."

Costs for Building 1 - Out of town office block

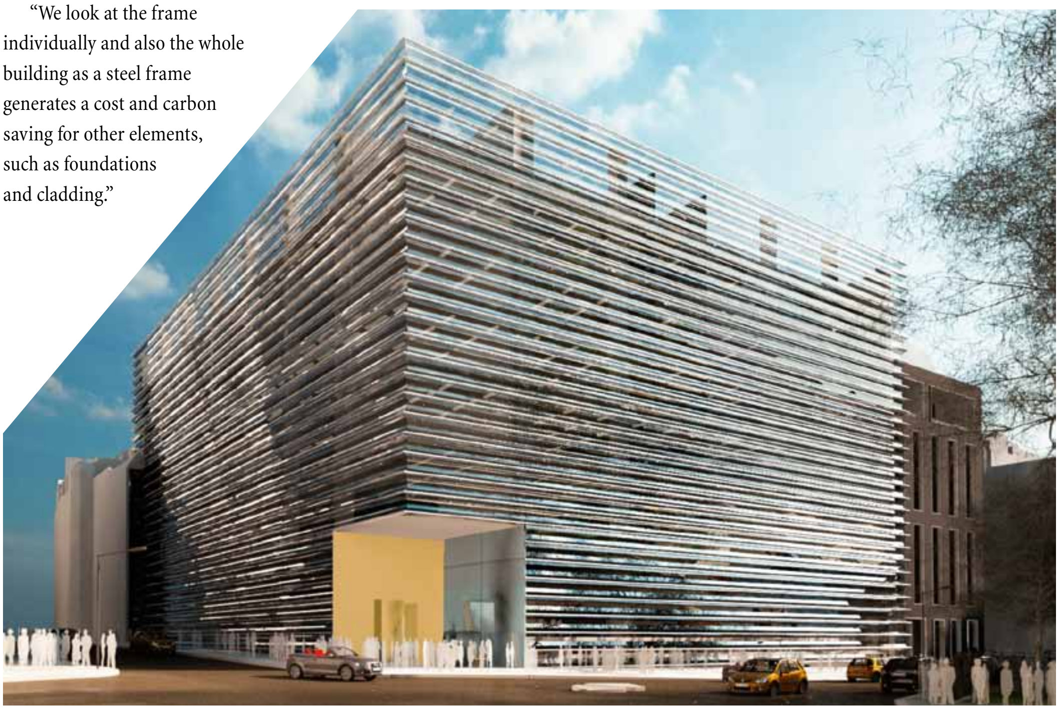
Expressed in £/m² gross internal floor area

	Steel composite	Steel + precast concrete slabs	Reinforced concrete flat slab	Post-tensioned concrete flat slab
Substructure	£52	£55	£67	£62
Frame and upper floors	£140	£151	£155	£150
Total building	**£1,535**	**£1,561**	**£1,631**	**£1,610**

Costs for Building 2 - City centre office block

Expressed in £/m² gross internal floor area

	Steel cellular composite	Post-tensioned concrete band beam and slab
Substructure	£56	£60
Frame and upper floors	£194	£210
Total building	**£1,861**	**£1,922**



BCSA participates in health and safety myth busting

"Health and safety is often incorrectly used as a convenient excuse to stop what are essentially sensible activities going ahead," said Peter Walker, BCSA Health, Safety & Training Manager.

Many others are of the same opinion and this has prompted the Health and Safety Executive (HSE) to set up an independent panel known as the Myth Busters Challenge Panel - to scrutinise such decisions.

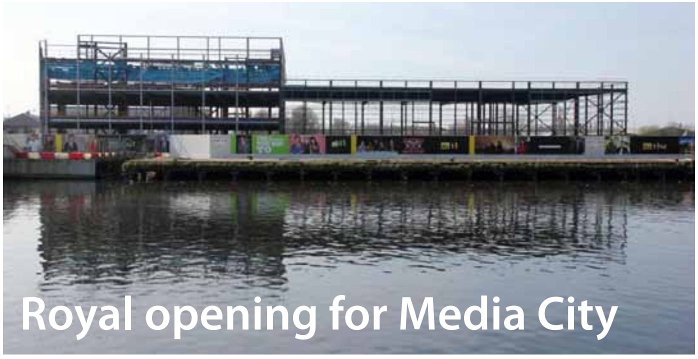
The Panel is chaired by the HSE Chair Judith Hackitt, with HSE Board member Robin Dahlberg acting as Vice-Chair. It is supported by a pool of independent members who represent a wide range of interests including small businesses, public safety, trade unions, the insurance industry and many outside interests where day-to-day common sense decisions on risk management are made.

Myth Busters will look into complaints regarding the advice given by non-regulators such as insurance companies, health and safety consultants and employers, and quickly assess if a sensible and proportionate decision has been made.

"We want to make it clear that health and safety is about managing real risks properly, not being risk averse and stopping people getting on with their lives," said Mr Walker who is a panel member able to offer advice that is relevant to the construction Industry.

Anyone who thinks a decision or advice that has been given in the name of health and safety is wrong, or disproportionate to what they were doing, can complain to the panel. It will investigate and publish its findings on the HSE website.

The contact form is available from: *http://www.hse.gov.uk/contact/myth-busting.htm*



Royal opening for Media City

Her Majesty the Queen has completed the official opening of the Media City UK complex in Salford, a project which required more than 8,000t of structural steelwork during its construction phase.

The first phase of this £650M development is centred on a state of the art digital production facility and a new headquarters for the BBC in the north. William Hare supplied and erected the steelwork for the main studio buildings together with the adjacent hotel and office towers.

Primary construction took place between 2009 and 2010 and was one of the largest construction projects in Europe during the last decade. William Hare completed the steelwork package on behalf of main contractor Lend Lease.

Currently on a separate Media City UK site on the opposite site of the Manchester Ship Canal, William Hare is erecting the steelwork for the new ITV Coronation Street Studios (pictured).

Working on behalf of Mace, the project includes two sound stage buildings, specialist production facilities and offices, dressing rooms and meeting space for staff.

The studios are scheduled to open in early 2013.

London cable car stretches across the Thames

Construction work on London's Emirates Air Line (cable car) has reached a major milestone with the completion of all three steel towers and the installation of a 1.1km long stretch of steel cable across the River Thames.

Passenger services between North Greenwich and Royal Victoria Docks are due to start this summer, with up to 34 cabins working simultaneously on the 90m high cables running between the two terminals.

The steel towers have been fabricated and erected by Watson Steel Structures (NSC February 2012) and have a combined steel tonnage of more than 1,100t. One tower stands on the river's south bank, with the other two located on the north shore.

The North Intermediate Tower was the first to be erected and it stands at over 65m tall, the other two towers are 90m high.

Each tower is topped with a Doppelmayr head which allows the cabling to run across the tops of the structures. The cabling, made of twisted steel comprised of nearly 300 separate strands of 50mm thick steel, was pulled into place and tensioned using a 12t winch located on the platform of the south terminal building.

NEWS IN BRIEF

Voortman will be holding Product Introduction Days at its facility in Rijssen, The Netherlands on June 28 and 29. The company will demonstrate a large number of steel processing units, including five new machines, while a series of industry related seminars will also take place. For more information visit *www.voortman.net/pid*

What is claimed to be the world's first fully automated robotic coping line has been installed at **ASD Westok**'s production facility in Leeds. The line is a Kaltenbach KC1201 and has been installed to produce the cut-out profiles of the company's cellular beams. Martin Clarke, ASD Westok Managing Director said: "Our new coping line advances and streamlines our production and adds improved control and integration."

Metsec has launched the latest version of its building shell design software MetSPEC 12, which includes design analysis to structural Eurocode EC: Part 1.3. The software is compatible with most Microsoft packages and features optimised wall face loading, a new eaves beam calculator, links to FrameSPEC for the design and specification of Metsec Steel Framing Systems, and links to LatticeSPEC.

Graitec has launched Advance Steel 2012, the latest version of its structural steel detailing software. The company said the new version increases general detailing and fabrication productivity, and includes its own graphics engine as well as the option to use it with or without AutoCAD. Graitec has recently announced a 52% growth in sales of Advance Steel software for 2011 compared to 2010.

AROUND THE PRESS

RIBA Journal
March 2012
Ghost Busting
It's asking a lot, but if a building were a Transformer, the Sainsbury Centre, now in its 34th year, would be its Optimus Prime, the veritable pro-genitor of the UK big shed typology. Its east face an enormous glass proscenium, its white triangulated steel columns and trusses framing a sylvan setting.

Building Magazine
23 March 2012
Landmark £7.5M BIM deal
"Moving to BIM is about more than implementing new technology - to fully realise its benefits requires a process change," Roland Zelles, vice-president of worldwide sales for Autodesk Architecture Engineering and Construction.

Construction News
5 April 2012
Academy models the benefits of BIM
[Thomas Ferens Academy, Hull] There are of course endless advantages to the full integration of BIM into schemes before, during and beyond the construction phases which is why the government has made its adoption key to future work. The steel framed academy features a central core and atrium, and a structural steel frame.

RIBA Journal
April 2012
Striking the right note
[Bramall Building, Birmingham University] The 15m diameter steel roof dome at the top sits on the 4m deep steel Vierendeel trusses over the auditorium, which keeps it column free. "Our dome was formed of 200mm thick hot rolled steel sections with a softwood planks and ply outer layer," says Will Schofield, GHA project architect.

Building Magazine
20 April 2012
Steel Insight - Multi-Storey Offices
The study illustrates that for both typical office building types, on a like for like basis steel framed solutions are highly competitive, with the frame and upper floor costs for the steel framed options being potentially up to 9% lower than for concrete.

Olympic water polo venue completed

One of the final pieces of the London 2012 Olympic Park - the Water Polo Arena - has been completed and will begin to host test events during May.

The temporary arena has a 5,000 seat capacity and was built in just 13 months. Firms from across the UK constructed the venue, with the steel frame being fabricated, supplied and erected by Caunton Engineering.

The venue is covered by a silver-coloured wrap and an inflatable roof, made from recyclable plastic. Within its interior, it holds almost three million litres of water in the warm up and competition pools.

Located adjacent to the Aquatics Centre, the wedge shaped structure will be dismantled after the Olympics with elements reused elsewhere in the UK, including incorporating materials available through the rental market to promote reuse and reduce construction waste.

Dennis Hone, Chief Executive of the Olympic Delivery Authority (ODA) said: "Completing the construction of the Water Polo Arena marks the end of the ODA's major venue work on the Olympic Park. That we've been able to do it using the combined expertise of companies from across the UK shows how British businesses can rise to the challenge of meeting the ultimate deadline – and exceed expectations. The unique sloping roof design makes it instantly recognisable and, as with all our venues, huge efforts have gone into both sustainability and ensuring we don't build venues that have no use after the Games."

New façades and cladding brochure

Lindapter has published a new Façades & Cladding Brochure, said to be tailored to architects and engineers working on building envelope design and construction, and demonstrating connections for securing cladding material to structural steel frames and hollow sections.

The brochure highlights the Lindapter connection systems for various architectural applications using 3D renders and clear line drawings, with assemblies drawn from Lindapter's project experience.

Visit *www.lindapter.com* to download or request a copy of the 28 page brochure.

Seminars to boost steel construction knowledge

Kingspan Structural Products has developed a CPD Seminar which has been approved by Construction CPD Certification Services. The seminar reviews the history of structural materials used in construction with particular focus on the evolution of steel.

The CPD discusses the different components used in steel structure and explores issues which may need to be considered when specifying structural materials. These include designing to Eurocodes or British Standards and the consideration of sustainability and health and safety. It also provides a comparison of cold rolled structural materials available in the current market, paying particular attention to different types of purlins.

Kingspan manufactures cold formed structural products including Multibeam purlin and rail systems.

The company has recently launched the Multibeam Component Weight App. This is said to be unique to Kingspan Structural products and allows you to calculate weights of purlins, rails, eaves beam and ancillary components based on the section size.

Once the App is open, one just chooses Multibeam, Mulitchannel or Eaves Beam and then scroll to the relevant section size to see the component weight values. You can then click on the ancillary icon to view the weights of ancillaries associated with that product.

Available for touch phones such as iPhones, iPods, iPads and Android, the App is downloadable from *www.Kingspanstructural.com*

Historic tea clipper Cutty Sark reopens

Her Majesty The Queen, accompanied by His Royal Highness The Duke of Edinburgh, has officially reopened the Cutty Sark, the world's last surviving tea clipper and one of the UK's greatest maritime treasures.

Following an extensive conservation project, with major support totalling £25M, the ship is once again open to the public.

Housed in its dry dock in Greenwich, the vessel has been raised 3.3m into the air and is now supported by a steel cradle framework which in turn is connected to the dock's walls.

The new steel support structure allows visitors, for the first time, to walk underneath the ship and view its hull, while the space between the vessel and the dock has been glazed creating a new gallery and exhibition area.

The project architect was Grimshaw and structural consultant Buro Happold. The lifting of the vessel and the installation of the new steel support structure as well as new deck steelwork and other structural elements were undertaken by S H Structures.

Software goes for BIM approach

AceCad Software has launched BIMReview - a collaborative BIM project review tool for design, procurement and construction teams in the building and construction industries, which debuted at the NASCC trade show in Dallas, Texas in April.

Richard Brotherton, Executive Director of AceCad, said: "BIMReview opens a world of endless collaboration opportunities on the BIM project. Users will experience new levels of capability, unrivalled in the industry, to deliver instant decision support across project stakeholders.'

BIMReview is the first release in AceCad's new BIM solutions for managing supply content from design to the construction site. It has been designed for project clients, steelwork contractors, architects, engineering teams, detailers, BIM managers, procurement teams, contractors, suppliers and site teams.

The company said it is a single software tool that can be used across disciplines, that is both intuitive and easy to use without training.

New structural roof decking brochure

Tata Steel has launched a new brochure focusing on its RoofDek range of structural roof decking and trays. Illustrated throughout, it highlights the comprehensive selection of structural roof decking solutions, with a detailed overview, including diagrams for RoofDek shallow and deep deck profiles, liner trays and fully tested acoustic solutions.

The brochure demonstrates compliance with Eurocode 3 Design of Steel Structures and Eurocode 9 Design of Aluminium Structures, soon to be mandatory in the UK and useful throughout Europe and the rest of the world.

RoofDek products range from 32mm to 210mm, with a wide choice of structural trays. They support all types of insulated roof systems, including single ply membranes, standing seam systems, green roofs, slates and tiles, three ply felt and asphalt.

Visit *www.tatasteelconstruction.com/roofdeksterity* to download a copy of the brochure

Diary

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

17 May 2012
Selection of steel Sub-Grade
1 hour free webinar

22 May 2012
Steel Connection Design
Manchester

12 June 2012
Loading to BS EN 1990
1 hour free webinar

19 June 2012
Steel Frame Stability
Birmingham

12 July 2012
Combined axial load and bending
1 hour free webinar

Topping out a record breaker

Steelwork erection for the Shard's uppermost levels, known as the Spire, has been completed. NSC reports from western Europe's tallest building, a project where pre-assembly and modular construction have taken centre stage.

FACT FILE
The Shard, London
Client: Sellar Property Group
Architect: Renzo Piano
Main contractor: Mace
Structural engineer: WSP
Steelwork contractor: Severfield-Reeve Structures
Steel tonnage: 13,000t

The final elements of steelwork for the top of the Shard (spire) were lifted into place during the last days of March, keeping the project on course for its imminent completion date. This notable landmark has set a new benchmark for high-rise construction, as the top was prefabricated into a number of modules.

The methodology of building the spire (levels 72 to 94) ensured it was assembled in as few pieces as possible, which led to fewer crane lifts and less time spent erecting the structure hundreds of metres in the air.

The project team also decided to make sure they ironed out any problems with this modularisation prior to going to site, and consequently carried out a complete offsite trial assembly at steelwork contractor Severfield-Reeve's Dalton facility. This focused on the optimisation of components, the order in which they would be delivered to site and the lifting procedure. The Spire was set out and fixed onto support points identical to those they would use on site.

This final element of the Shard's overall structure is 60m tall, weighs 530t and is made up of 460 pieces of steel.

"This part of the steelwork package had to be designed in a way to suit manufacture and safe site erection, and the modular solution meant we had fewer connections which meant less working at height," explains Severfield-Reeve's Project Manager Doug Willis.

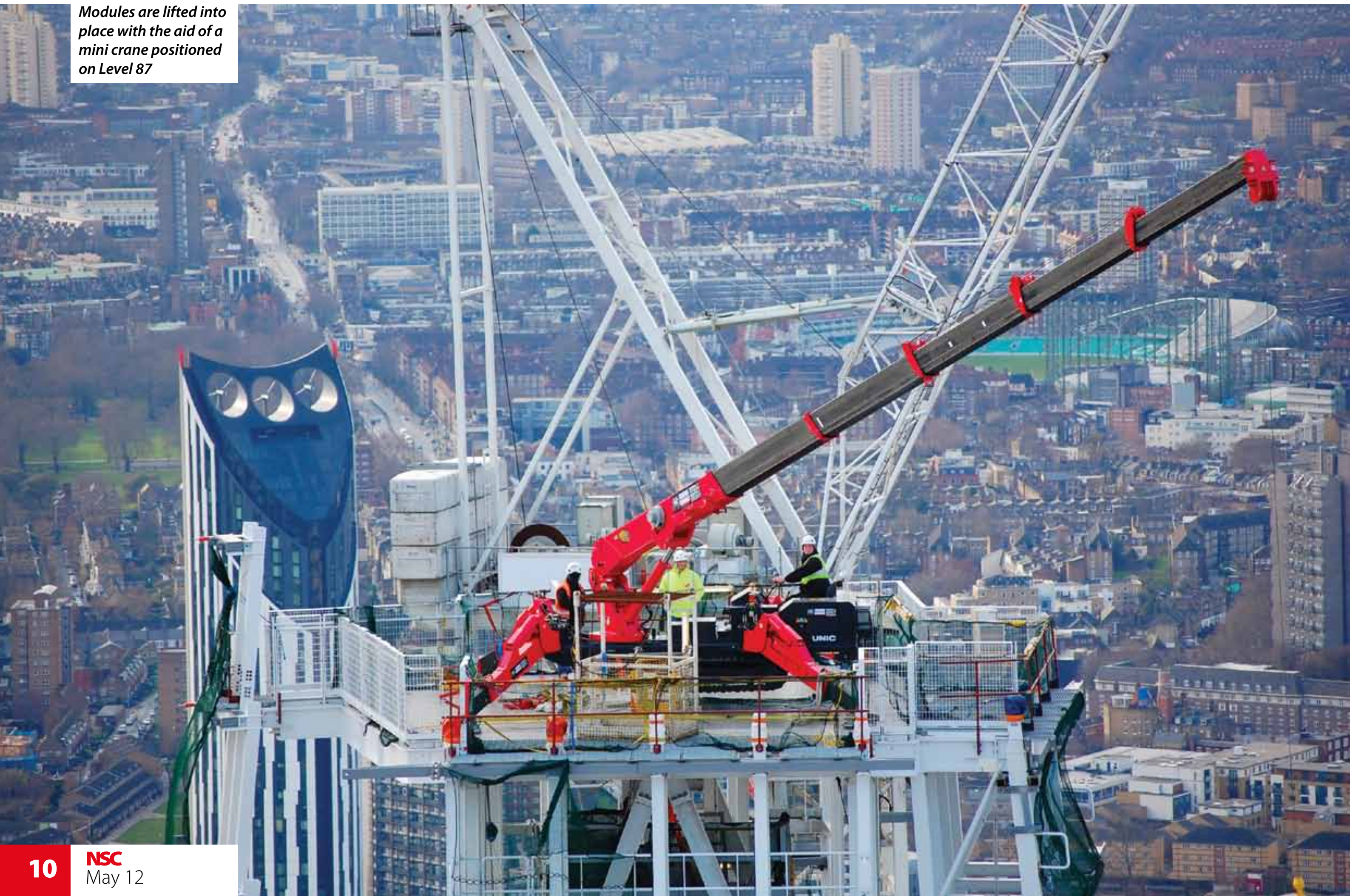
The modules all had to be within the on-site tower crane's lifting capacity of 7t, as well as being transportable for the journey to London. Horizontal elements measured up to 3m x 7m, while vertical sections measured up to 3m x 7.8m. The installation process followed a regular sequence of erecting a steel core, followed by the outer elevations and then the floor panels.

"The modular solution meant we had fewer connections which meant less working at height"

Each floor is different. At level 72 it is composite deck, at level 75 solid steel plate with waterproofing detailing (this is the Shard's roof since, above this level, the structure is open to the elements). Above level 75 the floors are made up of open aluminium flooring, or a galvanized steel grill.

Each module was able to include elements such as the main structure, floor, catwalk gantries and cladding rails. However, where pieces became too large, they were erected as individual entities – such as for some cladding rails. To simplify some of the column-steel core connection details, stubs were pre-welded onto each component to

Modules are lifted into place with the aid of a mini crane positioned on Level 87



Modular construction meant fewer crane lifts were required make them easier to locate.

The sequence of construction consisted of erecting the central steel core first, then installing a temporary steel platform to support mobile elevating work platforms (MEWP's)which would be craned into position. The MEWP's allowed the steel erectors to build the external truss which would then cradle the modules, known as cassettes. Further connections were made possible by attaching erectors to a gallows-frame type post which sat on top of the steel core.

"The trial assembly made sure every bolt fitted in every hole so that on site, the guys in the MEWP's could bolt the underside of the module and the guys attached to the gallows could complete connections above," says Mr Willis. Not forgetting all the while that this work is taking place more than 250m above ground level, where adverse weather could bring operations to a halt at any moment.

At level 87, the highest of the floors, there is also a requirement to have a building maintenance unit which sits on stubs on the steel core. The steelwork cantilevers about 20m off level 87, which created a further challenge since it was even more exposed to the elements.

The highest crane lifts ever undertaken in the UK were needed for the last steel pieces

The Shard - the whole story

The Shard tops out at a height of 310m and more than 13,000t of structural steelwork has been erected on this project situated adjacent to London Bridge Station.

Said to be Europe's first major mixed-use building and designed by architect Renzo Piano, the Shard has a hybrid steel and concrete design. Steelwork has been used from ground floor to level 40, then up to floor 69 concrete takes over as the framing material, before the design reverts back to steel for the spire.

"By mixing and using the inherent structural characteristics of the building materials and frame types, we eliminated the need for any dampers," says WSP Director Kamran Moazani. "From the beginning our design philosophy was to fully optimise the structure and a hybrid system best suited this."

The lateral stability for the structure is based on a vertical spine consisting of a cantilevered concrete central core stiffened by a steel outrigger hat truss at high level (floors 66-69) engaging the perimeter columns of the building.

The central core stops at level 72, which is the top floor of an upper viewing gallery which extends from level 69 to 72. The gallery was erected by Severfield-Reeve as the initial segment of its second steel erection programme, to install the Spire, and was the first element of the modular construction segment.

Venue kickstarts town centre development

Structural steelwork is playing a starring role in the construction of a new performance venue in Doncaster.

Big changes are afoot in Doncaster town centre as a landmark £300M development programme takes shape over the next six to eight years. To be delivered in four stages, the grand scheme will cover 25 acres and includes the town's first public square, new civic offices and council chamber, residential blocks and a state of the art new performance venue.

Known as the Civic and Cultural Quarter, the scheme will revitalise the Waterdale area of Doncaster, attracting people and businesses which in turn will have a positive impact on neighbouring parts of town.

The new performance venue will be the centrepiece of the first phase of the development and it is set to transform the art and entertainment facilities across Doncaster and the region when it opens next year. Replacing the nearby 90 year old Civic Theatre, the venue will include a 620 seat theatre auditorium, a flexible second space with a capacity of either 200 seated or 400 standing, dance and drama studios, educational areas which can double up as meeting rooms, and a large foyer with a bar and cafe.

Work on the 5,250m^2 venue got underway late last year on a site previously occupied by a car park and before that by a college. Early works included levelling the site and installing pad foundations in preparation for the main concrete and steelwork programmes.

The structure has a hybrid design, with concrete being used for the walls of the auditorium and the flytower, and a steelwork frame wrapping around the building and knitting the whole structure together.

"Concrete has been used for acoustics,

Impressions of the venue's main auditorium and the foyer's feature wave form wall

The venue is the initial phase of Doncaster's Civic and Cultural Quarter

Steelwork forms the front elevation which will have a copper clad central box

while steelwork has provided us with the desired speed of construction and the long roof spans in the auditorium," says Martin McGovern, Arup Associate.

The most prominent part of the main auditorium is the 25m high flytower constructed with in-situ concrete. This is attached to two concrete walls that form the east and west auditorium elevations. This creates the shell of the acoustically sensitive main theatre space. Steelwork then forms the roof, seating tier and the surrounding frame, connecting into the concrete at numerous points.

The project's largest steel elements are a series of 20m long trusses spanning the auditorium roof. Two of the trusses span the flytower and will support walkways and scenery above the main stage. Consequently they are 3.2m deep, compared to the other trusses over the seating areas which are 2.4m and 1.2m deep.

The trusses are all being brought to site in halves, assembled on the ground before being lifted into place as completed units, with the two deepest trusses weighing 12t each.

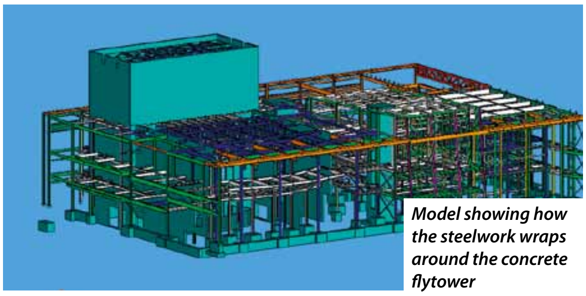
"The on-site tower crane was installed specifically with these trusses in mind," explains Ben Shearman Vinci Construction UK Senior Project Manager. "They are the heaviest elements on the project and we had to have a crane with adequate capacity."

As well as forming the roof, steelwork also forms the auditorium's upper seating tier and back-of-house areas. Here a two-way cantilevering steelwork configuration provides the seating at the front and the office spaces to the rear, while also providing the stability and support for a large 20m long × 12m high plasterboard wave form feature wall, which separates the theatre from the foyer.

Although structural steelwork creates the majority of the building's frame, another significant hybrid construction area is the flexible second performance space. This smaller performance area will accommodate spectators on a first floor balcony that runs around the entire hall, while the open plan area is formed by a number of 15m long 3m deep roof trusses.

In order to create an acoustically isolated area, this space is a box within a box, with an outer concrete encased perimeter line of columns installed around another inner line of steel columns.

The columns to be encased in concrete were erected along with the rest of the steel frame by Elland Steel Structures. Once they were up the area was handed over to the concrete contractor who then poured the surrounding structural concrete around the steel members.



Model showing how the steelwork wraps around the concrete flytower

"This was another example of how the steelwork and concrete contractors had to coordinate their work," says Mr Shearman. "There are also a lot of interfaces between the two materials and this required Elland to supply cast-in plates to the concrete contractor to be installed in the auditorium walls and the flytower."

Elsewhere in the structure the steel frame forms two other large studios and three floors of rehearsal rooms and offices. Concrete lift shafts and the auditorium walls provide the steelwork with its stability, but in some areas bracing has been installed.

The majority of the front elevation of the building will be glazed and to accommodate the glass a series of bespoke fabricated 12m high feature columns have been erected. The middle portion of the front façade will be the structure's focal point as it features a cantilevering box to be clad in copper.

Due to be completed in April 2013, the Mayor of Doncaster, Peter Davies says the venue presents an historic moment for the town. "With its numerous performance spaces and world class facilities it will be another big attraction our residents and visitors can benefit from."

FACT FILE
Doncaster New Performance Venue

Main client: Doncaster Metropolitan Borough Council
Developer: Muse Developments
Architect: Arts Team RHWL
Main contractor: Vinci Construction UK
Structural engineer: Arup
Steelwork contractor: Elland Steel Structures
Steel tonnage: 760t
Project value:£16M

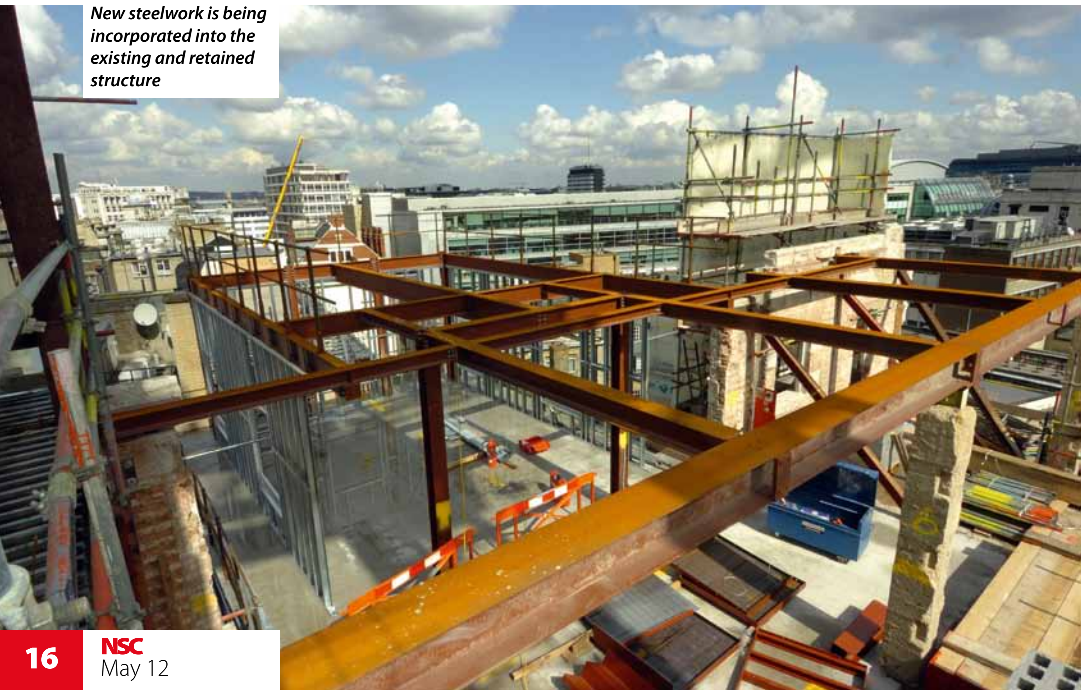
The new rear elevation takes shape

FACT FILE
Africa House, London
Main client: Freshwater
Architect: JMA
Main Contractor: BAM Construction
Structural engineer: Taylor Whalley Spyra
Steelwork contractor: Graham Wood Structural
Steel tonnage: 800t
Project value: £22.5M

Steelwork incorporation

Retained façades and original steel framework have been incorporated into a new and enlarged modern and reconstructed office building in London. Martin Cooper reports on a project where steel construction has played a delicate balancing act between new build and listed structure.

Built in 1921, Africa House is a Grade II listed commercial building on Kingsway in central London. Positioned as it is in a prime location, the structure, like many of its contemporaries, has remained in use throughout its lifetime, serving as a headquarters for numerous companies.



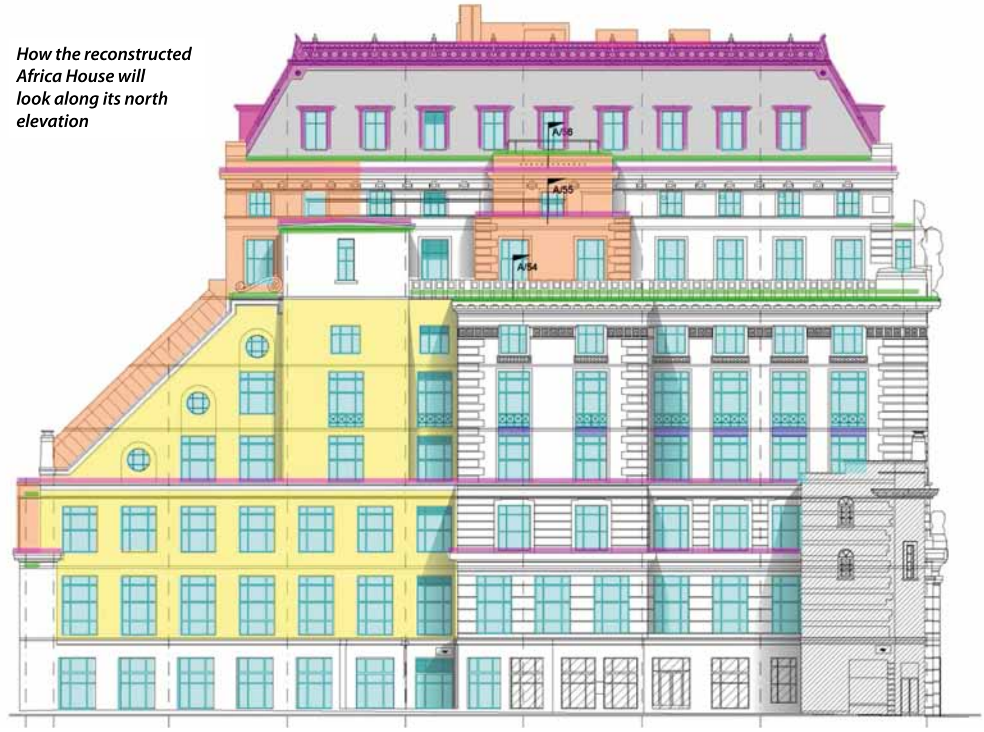
New steelwork is being incorporated into the existing and retained structure

Early twentieth century interiors however are not conducive to modern working practices, and in order to bring Africa House into the present era an extensive reconstruction programme is underway.

Retaining the majority of its Portland stone façades, including the double height fluted screen and arch which fronts Kingsway, the building is being stripped entirely apart from its listed areas.

The rebuilt Africa House will include a new traditional two storey mansard roof (incorporating one new extra floor of offices with a plant area above on the ninth level); the insertion of a new contemporary core infilling the rear lightwells, and the rebuilding and extension of the rear of the building, behind a sloping curtain walling façade.

The main front façade and the floors adjoining to a depth of 15m, are being retained. Beyond this point the majority of the original innards have been demolished, with a new steel frame being inserted, *The building's retained steelwork, much of it encased in concrete, has stood the test of time, remaining in good condition and this has aided the connections and erection of the new frame.*



How the reconstructed Africa House will look along its north elevation

creating a modern open plan office environment. However, other original elements of Africa House are remaining in place, such as a listed main staircase, which is situated near to the main Kingsway entrance.

To open up and create larger access points to the staircase, steelwork has been inserted into the original retained walls. A series of steel goal posts, forming large openings, have been erected on each level above first storey.

Beyond the retained staircase a lightwell is being converted into an atrium, featuring a scenic lift; two more conventional style lifts will be located close by in a new core.

Just to make things a little more complex, the construction programme is also being carried out while retail tenants, who occupy parts of the ground floor, continue to trade. This means much of the ground floor level has remained untouched and the new second floor has been asphalt covered, keeping the retained areas below watertight. "Projects of this nature in central London have been my bread and butter for many years," commented Bob Wright, Project Director from the client's project manager Parsons Brinckerhoff, "but this reconstruction is as complex of any of them."

All of this structurally challenging work will increase the building's gross floor area to 15,000m^2, while upgrading it to a BREEAM 'Excellent' project.

Structurally, Africa House features load bearing masonry façades (Portland stone) with the majority of the innards consisting of a steel frame, built around a varying grid pattern. Steelwork contractor Graham Wood Structural has opted for bolted connections, where the new steelwork joins the original steel. "Where new steel beams adjoin a retained façade, new padstones have been installed," says Justin Brown, BAM Construction Project Manager.

The new steelwork frame forms a T-shape, with the upright part of the letter stretching backwards from the staircase and the horizontal line of the T forming the new rear tiered façade.

New steelwork connects to existing steelwork in many locations

Prior to installing any new steel a considerable amount of temporary steelwork had to be used in order to stabilise the remaining old steel frame after demolition had been concluded. Congesting an already tight and busy site, props to the retained façades and slabs were also positioned inside the project's footprint, as well as bridging beams above the ground floor retail outlets.

"The design of the new structure is a large balancing act," explains Bob Taank, Director at Structural Engineer Taylor Whalley Spyra. "We had to make sure the new extra loadings from the steel frame would not overload the façades and the retained areas of the ground floor. We were continually trying to match the new loads with the original loads."

Luckily during pre-construction surveys it was concluded the building's substantial masonry façades would be able to absorb extra loadings, and this was also the case in many parts of the retained ground floor where masonry piers were sufficiently robust to accept new loadings from above.

However, this was not the case in other areas, particularly the rear elevation which has been retained up to the second floor. This façade includes a series of brick piers which could not support a new steel frame to be erected above.

"We had to install steel spreader beams between the piers so the new steel frame's loads are absorbed by a number of retained columns," says Mr Taank. "This configuration continues up to fifth floor level, where the new façade steps in."

The rear elevation's two slopes are glazed, and this lightweight material lessened the extra loadings.

"We also maintained thin floor slabs, in keeping with the existing building," points out Mr Taank. "This also reduced loadings."

This balancing act also came into play while designing the new eighth (extra) floor for the building and the rooftop plant zone. Africa House's entire original roof was removed and the new two-level mansard levels are being erected in its place. Loads from this area are transferred to a combination of the retained façades, the new steel frame and some concrete piers – lower down the structure – via the spreader beams.

Erecting a new steel frame and connecting it into an existing one, albeit one that is 90 years old, will always throw up interesting and unique challenges. However, the building's retained steelwork, much of it encased in concrete (possibly for fire protection), has stood the test of time, remaining in good condition and this has aided the connections and erection of the new frame.

The new and enhanced Africa House is due for completion in spring 2013.

History Box

Once it was completed in 1921, Africa House filled the last vacant plot remaining on the recently constructed Kingsway thoroughfare. Architect for the project was Trehearne & Norman and they chose the building's hybrid masonry/steel frame design. This design maximised steel's lightweight construction and ease of erection (even in the labour intensive early twentieth century) for the building's innards, while masonry was used for the elevations to fit with the structure's neighboring buildings. Engineers for the original project were Berrycroft of London, while the steelwork contractor was Edward Webb of Manchester, a company sadly no longer in existence. Some of the steelwork was supplied or bought from Dorman Long; its name is stamped on many of the retained girders.

Speed of construction is of utmost importance to the client

Big is best for distribution

FACT FILE
Tesco Distribution Centre, Reading
Main client: Ashton Smith Associates
Main contractor: Vinci Construction UK
Structural engineer: Fairhurst
Steelwork contractor: Atlas Ward Structures
Steel tonnage: 2,600t

A large distribution centre in Reading is being constructed for Tesco, and steelwork's speed of construction is ensuring a tight programme is being adhered to.

Located on the outskirts of Reading, a large 83,984m^2 Tesco distribution centre under construction on a former brewery site, is set to provide in excess of 1,000 job opportunities for the area.

This £27M contract is being carried out by Vinci Construction and building work will be completed to a BREEAM 'Excellent' standard as the structure will emit 34% less CO_2 than the levels imposed by the 2010 building regulations.

Like the majority of large distribution centres this project is relying on structural steelwork to form the building. It is a portal framed structure with a 185m width, formed of six spans and a length of 448m comprising of 56 × 8m bays. To the underside of the haunch the warehouse is 14.5m high, while internally there is a 16m wide office mezzanine level which is eight bays long.

"These structures are usually steel framed as it's a tried and tested method of construction," says Vinci Construction Contracts Manager Rob Bull. "With steel you get a quick and economic construction scheme."

Speed is of upmost importance on this project as Vinci only started work on site during January and steelwork is helping to achieve a demanding programme.

The company inherited a brownfield site, where the previously decommissioned brewery had already been demolished. Much of the demolition material has been re-used, while large parts of the existing slab have been built over with the new structure's footprint. Vinci's early works also included driving 1,200 precast piles into the site, stabilising the footrprint and then installing pile caps with cast-in holding bolts in preparation for the steelwork.

Steelwork erection was completed last month (April) during an 11 week programme. "The weather was fine during March and as the ground was prepared and levelled prior to us starting, we were able to get a good start," explains Richard Woodhead, Atlas Ward Structures Project Manager.

For the most part, Atlas Ward has had 15 steel erectors on site, using two mobile cranes and nine mobile elevating work platforms. Typically, erecting a large multi-span distribution centre like this involves sequencing the frame into erectable sectors. This is precisely what Atlas Ward did, with

The six span structure takes shape rapidly

Building work will be completed to a BREEAM 'Excellent' standard as the structure will emit 34% less CO_2 than the levels imposed by the 2010 building regulations.

strips of the building up to 10 bays deep, erected span after span. Once a strip of all six spans was erected, the process began again.

Initially the erectors had to make use of temporary bracing to help stabilise the steelwork, but after the first phase was up, the portal frame was self supporting.

"The size of the phased sequence depends on the location of the internal valley columns," adds Mr Woodhead. In this case they are spaced at 16m intervals, meaning each phase of the erection process had a corresponding depth.

Interestingly, all of the job's internal valley columns are plated members fabricated in-house on the Severfield-Rowen group's plate line. These members are said to achieve greater cost effectiveness for structures like this, and Atlas Ward invariably utilises them for most of the distribution centres it erects.

The distribution warehouse also includes three attached ancillary buildings, a goods in and a goods out 'pod', and a battery charging store. These single storey structures vary in size, but are a maximum of 26m wide and up to 24m long.

These substantial lean-to structures are all connected to the warehouse's main frame steelwork but they are nominally independent structures. The site also includes a separate Vehicle Maintenance Unit (VMU); a steel framed building which is approximately 35m wide by 34m long, and includes a mezzanine level.

Summarising the job, Alan Connell, Fairhurst Partner says the sheer size of the distribution centre was the main design challenge.

"We were pushing the boundaries of steel design with this building's width and so there could have been pressures on its longitudinal stability without some careful planning."

A structure of this size also demands some stringent fire engineering to ensure there is adequate smoke control.

"In the past buildings of this size would have required dividing fire walls, but our understanding of fire engineering has improved and this has allowed us to design open plan structures of this size," says Mr Connell.

The structure's width is said to have challenged and pushed the boundaries of steel design

A design in isolation

A number of performance spaces, all needing to be acoustically isolated, have been constructed with a complex steel design at the new Guildhall School premises in London.

Exterior of the new school premises

All columns in the concert hall rest on acoustic bearings

The renowned Guildhall School of Music and Drama has embarked on a major building project to expand its City of London facilities. Known as Milton Court and located adjacent to the school's current building, the new premises will open next year providing state of the art performance and teaching spaces. Combined with its neighbour, the Barbican Arts Centre, it will be an international cultural destination

Part of The Heron development, that also includes residential accommodation, the lower floors of the scheme will house the school's new facilities and include a 608 seat concert hall, a 227 seat theatre, a studio theatre, three major rehearsal rooms and a TV studio suite.

The residential portion of the project consists of a concrete tower with the majority of school facilities housed in an adjoining steel framed structure. This school building goes up to level six and is formed by a series of full height plated girder columns which are connected to the concrete structure via 18m long roof beams forming a landscaped rooftop terrace.

The girder columns and roof beams form what has been described as the outer box, as all steelwork within this shell is acoustically isolated – a box within a box construction. Much of the internal steelwork (the inner box) has been infilled with concrete between flanges to enhance the acoustic performance. The roof girders were partially encased in concrete by the concrete contractor to form a high quality exposed concrete soffit to the concert hall. including the long roof beams. These concrete encased steel members weighed in at around 12t each and constituted steelwork contractor William Hare's heaviest steelwork lifts of the project.

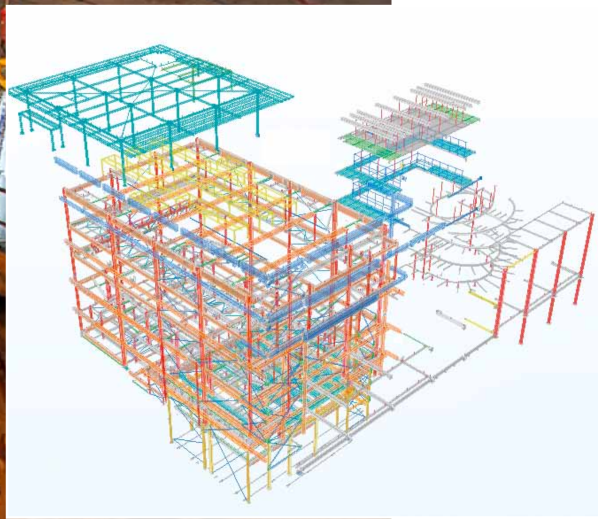
The steel design is very complex and because of the various performance spaces housed in the structure acoustically isolating each area is of upmost importance. "Only the perimeter columns are fixed to holding down bolts, inner box columns are all seated on acoustic bearings, without any fixings to the concrete below. This ensures that the acoustic gap is maintained, meaning the inner box steelwork is floating," says Gary Simmons, William Hare Technical Director.

Between the outer perimeter steelwork and the inner box there is a continuous acoustic cavity to prevent sound transfer from outside to the inner box and between individual inner box spaces, such as the basement studio theatre and rehearsal rooms.

Isolation extends beneath the floors by use of 'floating slabs' on acoustic bearings. These slabs are formed using Omnia plank slabs on inverted steel T sections, which are supported on bearings. There are a multitude of floor slabs at varying levels, forming the theatre's stage, seating areas, storage levels and scenery lift space. All of these slabs are supported by steelwork and constructed with either metal decking or precast planks.

With so many interfaces between concrete and steel as well as the multitude of isolated levels, coordination between all of the projects trades was all important. Daily meetings were held to discuss progress and which areas were ready for further steelwork erection or concreting.

A key design feature of the steel frame was ensuring temporary stability and lateral restraint to the columns due to the absence of holding bolts on most of the columns. Temporary restraint brackets were used to tie the inner box frame to the concrete frame



Cantilevering steelwork is hoisted into place within the flytower

FACT FILE
Guildhall School of Music and Drama, London
Main Client: City of London/Heron International
Architect: RHWL
Main contractor: Sir Robert McAlpine
Structural engineer: WSP
Steelwork contractor: William Hare
Steel tonnage: 1,100t

Isolation extends beneath the floors by use of 'floating slabs' on acoustic bearings.

to maintain stability until the floating slabs were cast.

A careful checking process was undertaken by the project team and this ensured every temporary bolt was removed, as a single bolt crossing the cavity would compromise the required acoustic performance.

Interestingly, the school was not always going to be a steel framed structure, in fact it was initially conceived as a precast concrete solution.

"We undertook a value engineering exercise and changed the design to a more cost effective steel framed solution with masonry infill walls," explains Matthew Colman, WSP Project Engineer. "Although the detailing of interfaces with the acoustic consultant was more challenging."

The main school structure is separated from the concrete residential tower by an atrium. Beyond this the lower levels of the tower also accommodate Guildhall facilities, primarily a 227-seat drama theatre.

William Hare has installed a number of steelwork elements into this area as well. Although the theatre is a concrete structure, steel forms the flytower and the cantilevering seating tiers.

Installing this steelwork required a lot of preplanning and coordination between William Hare and the concrete contractor. Construction of the residential tower was on-going, with the lower levels completed when the steelwork was inserted. As there was no tower crane available all of the steelwork had to be brought to site piece-small and hoisted into place with a chain and block.

Cast-in plates had been put in place during the concreting works, in readiness for the steel erection of the cantilevering seating tiers which hang from the theatre's curved concrete walls.

"Planning was vital for this part of the project," says Martin Sheward, Sir Robert McAlpine Project Manager. "We knew in advance that no crane would be available, so William Hare had to design the flytower so it could be brought in small transportable pieces."

The project is scheduled for completion early in 2013.

Floating slabs in the concert hall are formed with steel beams on bearings

Canopies supported on CHS columns form each block's entrance

Sustainable office accommodation

The EcoCampus at Hamilton is a sustainable business community providing open plan modern accommodation across three carbon neutral office buildings.

Street steelwork between each block were the last pieces to be erected

Sustainable buildings completed with sustainable construction methods are now the norm for many sectors. Energy efficient carbon neutral buildings are the way forward in an environmentally aware society and one commercial development in Scotland has led the way in this respect.

Located at the Hamilton International Park, the EcoCampus development consists of three separate three-storey office blocks, each designed to provide large open plan virtually column free floorplates which can be subdivided for multiple occupancy.

The business park is 13 miles south east of Glasgow on the A725 and is already well established, accommodating over 60 companies employing in excess of 6,300 staff which is set to rise to over 9,000 in the near future.

Close to the M77 and M8 motorways, the park also benefits from excellent public transport links, all of which have contributed towards EcoCampus' sustainability.

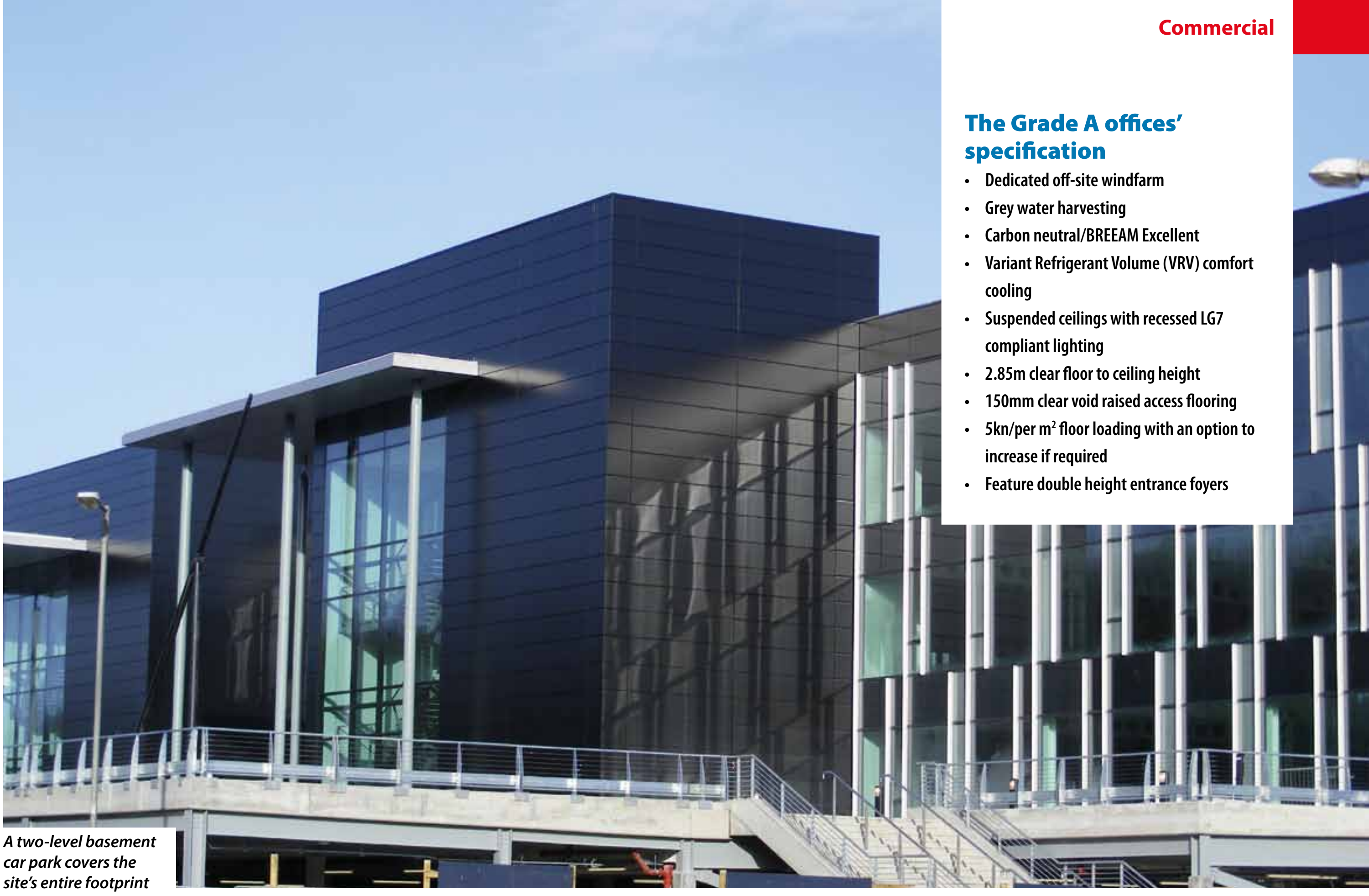
The project has already achieved a BREEAM 'Excellent' rating, also helped by the fact that the development will benefit from its own dedicated windfarm, providing all of its electricity needs. The developer, HFD Group, says that the EcoCampus is the first Grade A carbon neutral speculative office development in the UK.

Structural steelwork has been used as the framing material for each of the three blocks, with steel's recyclability further contributing to the projects sustainability credentials. The steelwork frame begins at basement level, forming a two level subterranean car park which covers the entire site's footprint. Above this there is a podium level, on top of which sit the three office buildings.

For the basement car park and podium deck the steelwork is supporting precast planks on an 8.1m × 8.1m grid pattern. Above in the office areas, the grid increases to a 16.2m × 8.1m grid pattern, still giving the buildings the desired open plan spaces. For the office accommodation the steelwork construction method changes slightly as the floor slabs are constructed with metal decking.

"Steel was the obvious choice for the project's framing material as it gave us the required spans and layout," comments Colin Morrison, URS Associate.

Known as Carrick House (C), Dunlee House (D) and Edzell House (E), the offices are of similar design offering 6,935m^2, 5,995m^2 and 7,908m^2 of floorspace respectively. Each structure has two steel braced cores, giving the structures their overall stability. Glazing features dominantly along all of the project's elevations, so bracing could not be located and installed



A two-level basement car park covers the site's entire footprint

The Grade A offices' specification

- Dedicated off-site windfarm
- Grey water harvesting
- Carbon neutral/BREEAM Excellent
- Variant Refrigerant Volume (VRV) comfort cooling
- Suspended ceilings with recessed LG7 compliant lighting
- 2.85m clear floor to ceiling height
- 150mm clear void raised access flooring
- 5kn/per m^2 floor loading with an option to increase if required
- Feature double height entrance foyers

in these areas, consequently it has been secreted in some internal areas around the cores.

A lack of internal bracing in some areas meant temporary bracing had to be installed in many zones during the erection programme. This was only removed once the concrete decks were completed, thus providing the required diaphragm action and structural stability.

Steelwork contractor BHC also installed the project's stairs and metal decking within its overall erection package. Using one mobile crane and one dedicated squad of erectors for each office block, the company erected the entire 2,500t of steel before the end of last year.

"Once the car park and podium was completed, the erection programme for each block was slightly staggered with C starting a few weeks before D which started before E," explains Stephen Kelly, BHC Project Designer.

Towards the end of the steel erection programme BHC had an extra (fourth) squad on-site to erect the final elements of the car park undercroft steelwork.

Once each of the three office blocks was fully erected, BHC still had to install some more steelwork in two streets that divide the buildings.

"The street steelwork consists of canopies which we left to last to allow us better access between the blocks during the main erection programme," says Mr Kelly.

Another element of the steelwork which was erected towards the end of the programme were a series of 15m high CHS columns which support the main entrance canopies for each block. These feature members will complement the main access points to the building's and their aesthetic appeal has been enhanced with pin connections at the top and bottom.

Construction work on the EcoCampus was completed in February.

FACT FILE

The EcoCampus, Hamilton International Park, South Lanarkshire

Client: HFD Group Limited
Architect: Mosaic Architecture
Main contractor: Balfour Beatty
Structural engineer: URS Infrastructure & Environment
Steelwork contractor: BHC
Steel tonnage: 2,500t

BHC used a dedicated erection gang for each building

Steelwork erection progressed simultaneously on all blocks

Columns in simple design according to the Eurocodes

Dorota Koschmidder of SCI explains the simplified method of designing continuous columns in simple construction according to the Eurocodes.

Introduction

Structures of simple design are composed of members connected by nominally pinned joints and resistance to horizontal forces is provided by bracing. This assumption makes the design of beams much easier, as each of them can be treated as simply supported. Beams are connected to the column face usually inducing a small bending moment in the column because of the eccentric application of transferred force. The columns are usually continuous over the height of the building.

Design rules regarding continuous columns in simple structures were given starting from the early versions of BS 449. BS 5950-1:2010 gave simplified rules specifically for this type of construction in Clause 4.7.7. However in BS EN 1993-1-1 the only option for members in combined axial compression and bending is the general guidance in Clause 6.3.3 (4), which is very complex compared to the elegance of Clause 4.7.7 in BS 5950. The subject of columns in simple design structures is addressed in the UK-specific NCCI: Verification of columns in simple design - a simplified interaction criterion, SN048b-EN-GB. This document can be found at *http://www. steelbiz.org/*.

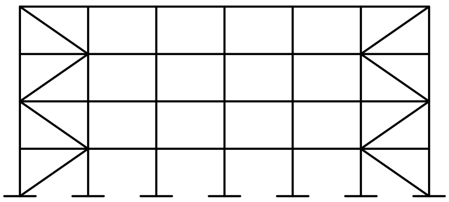


Figure 1: Example of simple construction

BS 5950 rules

BS 5950-1 offers comprehensive guidance for columns in simple design. There is no need to consider pattern loading – all the beams supported by the column should be assumed to be fully loaded. To determine the nominal bending moments in the column, beam reactions are taken as acting 100 mm from the face of the column, with the exception of members supported on cap plates.

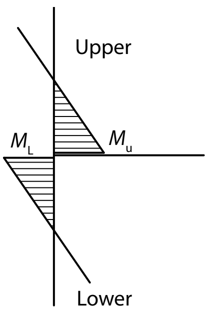


Figure 2: Distribution of nominal moments from floor beams

The moment applied by these eccentric reactions should be divided between column lengths above and below the level considered in proportion to their stiffness (as shown diagrammatically in Figure 2), unless the stiffness ratio is below 1.5, in which case the moment may be divided equally.

The buckling resistance moment for simple construction M_{bs} is determined using an equivalent slenderness value of $\lambda_{LT} = 0.5L/r_y$, where L is the distance between levels, at which the column is laterally restrained in both directions.

General approach for members under combined bending and axial compression in BS EN 1993-1-1

Clause 6.3.3(4) of BS EN 1993-1-1 gives two expressions that should be satisfied for members under combined bending and compression.

$$\frac{N_{Ed}}{\chi_y N_{Rk}/\gamma_{M1}} + k_{yy}\frac{M_{y,Ed}+\Delta M_{y,Ed}}{\chi_{LT}\left(M_{y,Rk}/\gamma_{M1}\right)} + k_{yz}\frac{M_{z,Ed}+\Delta M_{z,Ed}}{M_{z,Rk}/\gamma_{M1}} \leq 1.0$$

And:

$$\frac{N_{Ed}}{\chi_z N_{Rk}/\gamma_{M1}} + k_{zy}\frac{M_{y,Ed}+\Delta M_{y,Ed}}{\chi_{LT}\left(M_{y,Rk}/\gamma_{M1}\right)} + k_{zz}\frac{M_{z,Ed}+\Delta M_{z,Ed}}{M_{z,Rk}/\gamma_{M1}} \leq 1.0$$

where:

χ_y, χ_z are the reduction factors for flexural buckling about the major and minor axes

χ_{LT} is the reduction factor for lateral-torsional buckling

k_{yy}, k_{yz}, k_{zz} and k_{zy} are interaction factors determined from either Annex A or B of BS EN 1993-1-1. The calculation of the "*k*" factors to either Annex is tedious and requires careful evaluation of effects coexisting in various situations.

Simplified guidance in SN048

This NCCI document was developed in order to offer a simplified expression for the verification of columns that will avoid the calculation of "*k*" factors required in Expressions 6.61 and 6.62 of BS EN 1993-1-1. The objective is to closely follow guidance similar to that given in BS 5950, so the initial assumptions are very familiar.

The NCCI gives rules for the design of columns of Class 1, 2 or 3 cross section under compression provided the following criteria are satisfied:

- The column is a hot rolled I, H or RHS section
- The bending moment diagrams about each axis are linear
- The column is restrained laterally in both the y and z directions at each floor level but is unrestrained between floors



- The bending moment ratios (ψ_i) as defined in Table B.3 in BS EN 1993-1-1 are below the values given in Tables 2.1 or 2.2 in the NCCI document SN048.
  Or
  If the column base is nominally pinned ($\psi_y = \psi_z = 0$) the axial force ratio is such that $\frac{N_{Ed}}{N_{y,b,Rd}} \leq 0.83$, where $N_{y,b,Rd}$ is the resistance to buckling about the major axis.

When the above mentioned conditions are fulfilled member verification may be carried out using the simplified expression:

$$\frac{N_{Ed}}{N_{min,b,Rd}} + \frac{M_{y,Ed}}{M_{y,b,Rd}} + 1.5\frac{M_{z,Ed}}{M_{z,cb,Rd}} \leq 1.0$$

where:

N_{Ed} , $M_{y,Ed}$ and $M_{z,Ed}$ are the design values of axial force and nominal bending moments about y-y and z-z axis respectively

$N_{min,b,Rd}$ is the lesser of $\frac{\chi_y f_y A}{\gamma_{M1}}$ and $\frac{\chi_z f_y A}{\gamma_{M1}}$, where χ_y , χ_z are the reduction factors for flexural buckling about the major and minor axes

$M_{y,b,Rd}$ is equal to $\chi_{LT}\frac{f_y W_{pl,y}}{\gamma_{M1}}$, where χ_{LT} is the reduction factor for lateral torsional buckling

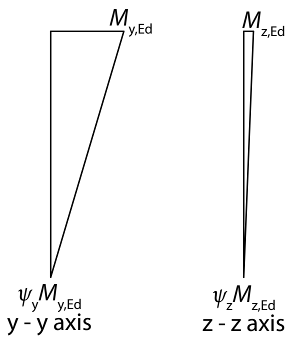
$M_{z,cb,Rd}$ is given by the expression $\frac{f_y W_{pl,z}}{\gamma_{M1}}$ for Class 1 and 2 sections and $\frac{f_y W_{el,z}}{\gamma_{M1}}$ for Class 3 sections, which is the same as the design value of the bending resistance of the cross section, when $\gamma_{M1} = \gamma_{M0}$.

In this Eurocode-compliant guidance there is no equivalent of $\lambda_{LT} = 0.5L/r_y$ slenderness reduction and the designers need to follow the general method of determining $\bar{\lambda}_{LT}$. Values of $M_{y,b,Rd}$ and $N_{min,b,Rd}$ can be taken from the SCI "Blue Book" (P363) for convenience.

Worked example

Consider a 203 × 203 × 46 UKC column in simple design in S275 steel subject to the following values of forces and moments:

Design compression force	N_{Ed}	= 589 kN
Design bending moment about the y-y axis	$M_{y,Ed}$	= 11.11 kNm
Design bending moment about the z-z axis	$M_{z,Ed}$	= 0.35 kNm



Axial force ratio and cross section classification

The design resistance obtained from SCI publication P363
$N_{pl,Rd}$ = 1610 kN

$$n = \frac{N_{Ed}}{N_{pl,Ed}}$$

Limiting value of n for Class 2 sections is 1.0

$$n = \frac{589}{1610} = 0.37 < 1.0$$

Therefore, under bending and N_{Ed} = 589 kN the section is at least Class 2.

Interaction criterion

As the sections meets the criteria in the NCCI document SN048, the simplified interaction equation may be used

$$\frac{N_{Ed}}{N_{min,b,Rd}} + \frac{M_{y,Ed}}{M_{y,b,Rd}} + 1.5\frac{M_{z,Ed}}{M_{z,cb,Rd}} \leq 1.0$$

For buckling length L = 5 m and $n \leq 1.0$ member buckling table from P363 gives the following values

$N_{b,y,Rd}$ = 1310 kN
$N_{b,z,Rd}$ = 762 kN
Therefore,
$N_{min,b,Rd}$ = 762 kN

Conservatively, the value for $M_{b,Rd}$ may be taken from the axial and bending table in SCI P363 ($M_{b,Rd}$ = 109 kNm) where the values are based on C_1 = 1.0. However, a more exact value may be determined from the bending resistance table.

For a column nominally pinned at the base, C_1 = 1.77
For C_1 = 1.77 and L = 5 m it was calculated that $M_{b,Rd}$ = 135 kNm

For bending about the minor axis, $M_{z,cb,Rd} = \frac{W_{pl,z} f_y}{\gamma_{M1}}$

As the section is Class 2 and the UK National Annex to BS EN 1993-1-1 gives the same value for γ_{M0} and γ_{M1},

$$M_{z,cb,Rd} = M_{c,z,Rd} = \frac{W_{pl,z} f_y}{\gamma_{M0}}$$

The value of $M_{z, cb,Rd}$ = 63.5 kNm is obtained from SCI publication P363.

Therefore

$$\frac{N_{Ed}}{N_{min,b,Rd}} + \frac{M_{y,Ed}}{M_{y,b,Rd}} + 1.5\frac{M_{z,Ed}}{M_{z,cb,Rd}}$$

$$= \left(\frac{589}{762}\right) + \left(\frac{11.11}{135}\right) + 1.5 \times \left(\frac{0.35}{63.5}\right) = 0.86 < 1.0$$

Therefore the resistance of the member is adequate.

Conclusion

Design of continuous columns in simple construction is not explicitly covered in the Eurocodes, but there is NCCI available. Limitations on the application of the NCCI are usually not critical and the designers are given a simple interaction equation as an alternative to the general equations (6.61) and (6.62) given in BS EN 1993-1-1.

AD 367
Construction loading for composite slabs – update to P364

This Advisory Desk Note provides clarification about the different design approaches adopted in worked examples in SCI publications P359 and P364. Although the numbering sequence of these two publications would suggest otherwise, P359 was published after P364 and, in relation to construction loading, incorporates a later interpretation of the design loading according to the Eurocodes. Therefore, the advice on construction loading in P359 (which incorporates advice given in AD346) supersedes that in P364. This Note highlights the differences between the two publications and advises where P364 should be updated.

Differences between examples in P364 and P359

The three key differences in determining the design effects due to construction loading between worked example 8 of P364 (published in 2009) and the worked example given in P359 (published in 2011) are as follows:

i) In P364, the weight of the wet concrete during construction was taken as 26 kN/m^3, (this includes an allowance of 1 kN/m^3 for its wet condition and 1kN/m^3 for steel reinforcement). In P359, the weight of the wet concrete is taken as 25 kN/m^3 and a separate allowance is made for the weight of the mesh reinforcement (for the A193 mesh, the value is 0.03 kN/m^2, significantly less than 1 kN/m^3 multiplied by a slab depth of 250 mm).

ii) In P364, the self-weight of the concrete slab during construction was considered as a permanent action (for which a partial factor of 1.35 applies, according to the UK National Annex to BS EN 1990). This interpretation overlooked the requirements of clause 4.11 of BS EN 1991-1-6, which states that the weight of fresh concrete is one example of construction load and that (all) construction loads should be treated as a single variable action (for which a partial factor of 1.5 applies). In P359, the weight of wet concrete is considered as a variable action.

iii) From its interpretation of wet concrete self weight as a permanent action, P364 concluded that expression 6.10(b) of BS EN 1990 results in the more onerous load combination at the construction stage. In P359, the weight of wet concrete is considered as a variable action and, since the combination factor for construction loads ψ_0 = 1.0 according to the UK NA to BS EN 1991-1-6, combination 6.10(a) is more onerous and thus determines the design effects at the construction stage.

Amendments needed to P364, example 8

In Section 8.3.1, replace the permanent action of slab self weight with that of the mesh (use 0.04 kN/m^2). Include an additional variable action due to self-weight of wet concrete at a density of 25 kN/m^3.

In Section 8.4.1, replace the statement that expression 6.10b applies with the statement that expression 6.10a applies, since ψ_0 = 1.0 according to the UK NA to BS EN 1991-1-6. As a consequence, the design udl will be 18.70 kN/m rather than 16.64 kN/m. Design moments and shears will increase as a result.

References

Brettle, M.E. Steel building design: Worked examples - open sections (P364), SCI, 2009

Simms, W.I. and Hughes, A.F. Composite design of steel framed buildings (P359). SCI, 2011

Advisory Desk Note AD346: Design actions during concreting for beams and decking in composite floors. New Steel Construction, vol. 18 (6), June 2010.

BS EN 1991-1-1: 2002. Eurocode 1. General actions. Densities, self-weight, imposed loads for buildings. BSI.

BS EN 1991-1-6: 2005. Eurocode 1. General actions. Actions during execution. BSI..

BS EN 1990: 2002. Basis of structural design, BSI.

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New and revised codes & standards

From BSI Updates April 2012

BS EN PUBLICATIONS

BS EN ISO 14174:2012
Welding consumables. Fluxes for submerged arc welding and electroslag welding. Classification
Supersedes BS EN ISO 760:1996

CORRIGENDA TO BRITISH STANDARDS

BS EN 1998-2:2005+A2:2011
Eurocode 8. Design of structures for earthquake resistance. Bridges
CORRIGENDUM 2
Also incorporates Corrigendum 1 and Amendments 1& 2

BRITISH STANDARDS WITHDRAWN

BS EN 760:1996
Welding consumables. Fluxes for submerged arc welding. Classification
Superseded by BS EN ISO 14174:2012

BRITISH STANDARDS UNDER REVIEW

BS EN ISO 14556:2000
Steel. Charpy V-notch pendulum impact test. Instrumental test method

NEW WORK STARTED

PD 6695-2:2008/A1
Recommendations for the design of bridges to BS EN 1993

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT – NATIONAL BRITISH STANDARDS

12/30261453 DC

NA to BS EN 1993-5 A1 UK National Annex to Eurocode 3. Design of steel structures. Piling

12/30261456 DC

NA to BS EN 1993-2 A1 UK National Annex to Eurocode 3. Design of steel structures. Steel bridges

ISO PUBLICATIONS

ISO 8503-1:2012

(Edition 2)
Preparation of steel substrates before application of paints and related products. Surface roughness characteristics of blast-cleaned steel substrates. Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces
Will be implemented as an identical British Standard

ISO 8503-2:2012

(Edition 2)
Preparation of steel substrates before application of paints and related products. Surface roughness characteristics of blast-cleaned steel substrates. Method for the grading of surface profile of abrasive blast-cleaned steel. Comparator procedure
Will be implemented as an identical British Standard

ISO 8503-3:2012

(Edition 2)
Preparation of steel substrates before application of paints and related products. Surface roughness characteristics of blast-cleaned steel substrates. Method for the calibration of ISO surface profile comparators and for the determination of surface profile. Focusing microscope procedure
Will be implemented as an identical British Standard

ISO 8503-4:2012

(Edition 2)
Preparation of steel substrates before application of paints and related products. Surface roughness characteristics of blast-cleaned steel substrates. Method for the calibration of ISO surface profile comparators and for the determination of surface profile. Stylus instrument procedure
Will be implemented as an identical British Standard

Quarry House (the new DH & DSS HQ) at Quarry Hill, Leeds

Described as a landmark building for the Quarry Hill area – which is being master planned by Terry Farrell – Quarry House includes 400,000 sq ft of office space for an anticipated 2,000 staff, together with a range of recreational facilities and extensive landscaping.

The new Headquarters of the Department of Health and Department of Social Security has risen to form a milestone in both construction and procurement. The client chose to adopt the design and construct route for procurement in order to achieve a very tight programme and Norwest Holst construction, (itself a subsidiary of the French construction giant SGE) was successful in securing the £57 million D & C package. BDP of Preston acted as Norwest Holst's Architect and Designer with George Depledge as Steelwork Contractor. Project Manager was AMEC Projects.

While responding to the concept design laid down by AMEC Projects, and to the master plan, BDP developed a design seeking to establish an appropriate image for this important civic building.

The reference design is based on a central axis, on which the building is placed symmetrically. The west elevation, with views down the site, terminates the axis of the Headrow-Leeds great boulevard, with a grand arch as the formal entrance to the building.

An essential stipulation of the design brief was for a traditional building with a contemporary look and a strong civic presence.

Quarry House is a formal design; the base is a granite plinth; the middle is a brick elevation incorporating York Stone; and the top is a slate mansarded roof. A curved theme is used throughout the building, from the striking entrances through the atria and into the design details. Two internal courtyards with atria are landscaped and form the corporate heart of each state department.

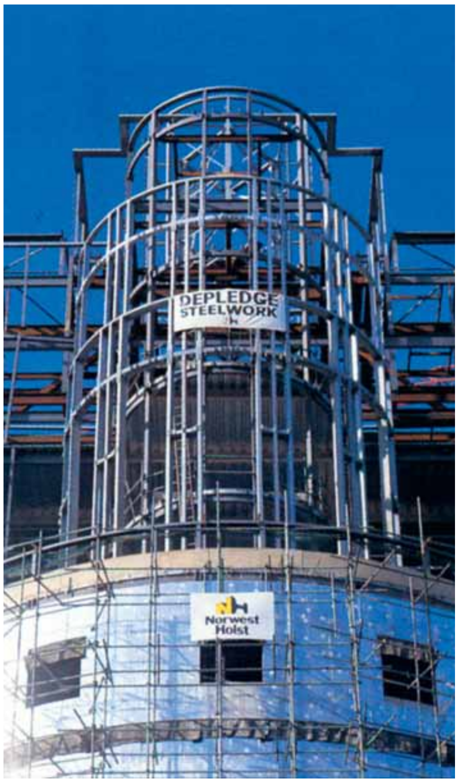
George Depledge & Co Ltd (a wholly owned subsidiary of Norwest Holst) fabricated and erected the steel frame which contained 3,000 tonnes of structural steelwork comprising over 12,000 pieces of steel. Depledge won the £2.5m contract partially due to the low transportation costs from their works at Midland Road, Leeds – only one mile from the site.

The client also saw a definite advantage in the selection of a fabricator that was certified to BS 5750: Part 1 (through the Steel Construction Q.A. Scheme Ltd). The quality systems that permeate Depledge's entire operations engendered client confidence in the success of the project.

This confidence was rewarded as lead time achieved from the receipt of client drawings to commencement of erection was less than 6 weeks. (The programme also required that Depledge achieve some of the fastest erection rates seen in the UK). This feat was made possible by meticulous planning, rapid fabrication and close co-operation between designer, contractor and fabricator. After fabrication the steel was shaken out at the works and delivered sequentially to the site on lorry mounted steel racks. Every lorry load contained several racks and each rack contained several pieces. The racks were delivered to site and lifted directly from the lorry onto the superstructure to suit the day's erection plan – this procedure minimised waiting time and maximised speed of erection.

The design and construct methodology enabled a number of major changes to be made to the structure during construction in order to reduce costs. These changes took place without having ana adverse effect upon programme. The project is currently within budget and on programme despite quite a heavy loss of time through inclement weather. The speed and flexibility of construction have made the project a fine example of the design and construct method of construction on a large scale and have proven the value of Depledge's commitment to quality.

Taken from
STEEL CONSTRUCTION April 1992



Aerial view of the new Cambridge University Press. In the foreground is the machine and warehouse area

FROM BUILDING WITH STEEL, MAY 1962

The New Cambridge University Press

Frederick S. Snow
C.B.E., M.I.C.E.
M.I.Mech.E.
P.P.I.Struct.E.
M.Cons.E.

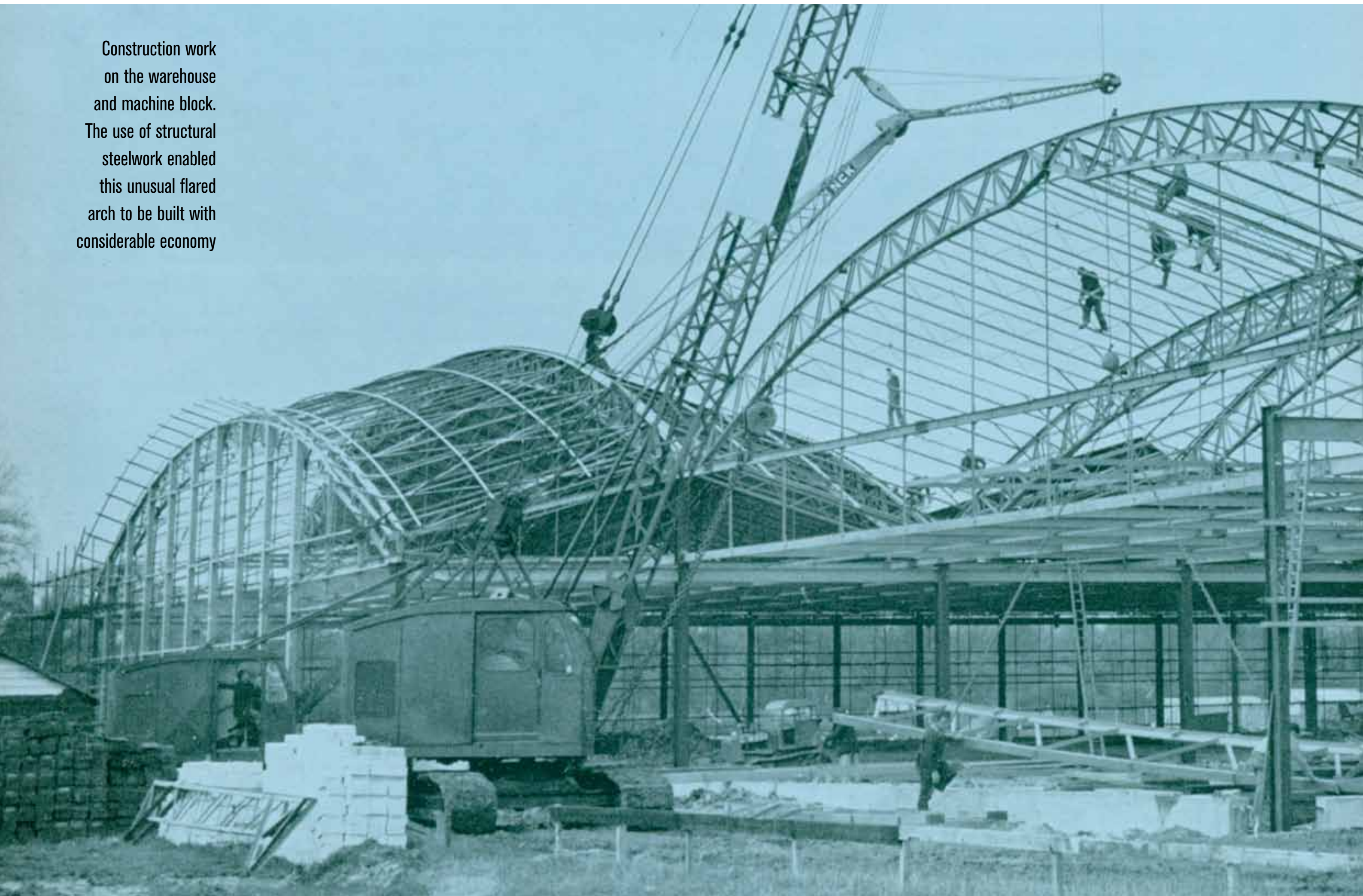
Low cost, high speed of erection and light weight were among the principal considerations which led to the choice of structural steelwork for the two large production blocks of the new Printing House now under construction for the Cambridge University Press. Situated on the outskirts of the town, the new premises will bring together the entire staff and printing equipment now housed in outdated buildings in the centre of Cambridge. Total cost of the new printing works will be about £1 million, and some 1,000 tons of structural steelwork will be used.

All the buildings are planned on a 12-ft module to provide integration between the production and the office areas and to simplify planning in the main factory blocks. Continuity between buildings is emphasised by the use of white and black mosaic finishes though variation is provided by means of aluminium sheeting to the production blocks contrasting with glazed curtain walling and occasional brick panels in the office blocks.

The largest single block is the machine and warehouse area, 33 ft long by 288 ft wide, which is covered with a roof of a curved and folded shape. The choice of roof structure for this main area was determined by several factors, the more important being:

1 Provision of clear spans of 144 ft. – only 1 row of columns within the building.
2 An interesting roof profile for aesthetic reasons.
3 Stanchion centres on a 24-ft. module.
4 External stanchions to be no wider than 12 in. on face when cased.
5 A clear space within the roof to be provided for air conditioning ducts and the numerous other services.
6 Continuous glazing to be provided on all sides, broken only by the columns.
7 Reasonably economic solution.

From consideration of point 5 it was obvious that most forms of trusses with diagonals were to be avoided, otherwise this would encroach on the intricate service layout and therefore an arch or shell form of construction was to be preferred. These designs also had the merit of being curved, thus giving



Construction work on the warehouse and machine block. The use of structural steelwork enabled this unusual flared arch to be built with considerable economy

Structural steelwork for the machine and warehouse area

an interesting appearance to the exterior (the interior being hidden by a false ceiling.)

Both concrete shell production and structural steelwork were considered for the scheme, and structural steelwork was preferred on the basis that, in addition to being considerably cheaper, it offered the same advantages since the appearance from the outside would be identical. Steelwork, also having the advantage of being lighter, necessitated smaller foundations; was faster to erect and less dependent upon weather conditions than a concrete shell.

The roof design chosen is a 144-ft. span lattice arch designed using normal British Standard mild steel angle purlins. The springing of every alternate truss is raised 7 ft. 6 in. to give a folded appearance to the roof. The secondary purlins running in the direction of the curve are only 2¼ in. by 2¼ in. by ¼ in. angles and although these were supplied straight they were quite easily bolted into position by hand to give the design curve. The arches themselves are built from two pairs of 6 in. by 4 in. by ⅝ in. angles back to back, laced together with 2 in. by 2 in. by ½ in. angles to form a lattice compression boom, and pinned down at crown and at supports. The bottom tie of the arch consists of two 8 in. by 3 in. channels back to back with vertical steel angle hangers to support it from the boom above.

A three-pinned arch was preferred to the two pinned variety because it did not involve any cost penalty and simplified erection. To give lateral support to the two compression members in the lattice arch, it was necessary to use lattice purlins made from angle sections top and bottom and a ¾ in. diameter bent mild steel rod welded between them, the bottom legs being inclined at the ends to support the lower pair of boom angles.

Expansion of the 32 arches - each weighing 8½ tons - is allowed for by use of phosphor bronze sliding plates under each truss at the internal stanchions and by the use of double trusses at the centre of the building with a ½ in. expansion joint between them. Torshear high-strength friction grip bolts were used in the joints of the arches.

It was not considered desirable to transfer any wind load to the crowns of the arches at the gables and, therefore, the wind of the gable is carried by a horizontal wind girder a ceiling level which spans between stanchions, and the reactions at the end of the wind girders are transmitted to the centre and side rows of stanchions by means of an R.S.J. at eaves level. This eliminates the need for bracing in the end bay which would appear unsightly in view of the fact that the glazing is continuous around the sides of the building.

Owing to the fact that the roof is inclined, its shape is elliptical, although the main trusses are circular in section. This posed some problems in the use of steel decking since the angle at the end of the sheets increases towards the end of the roof. However, it was considered that the radius (174 ft. 6 in.) was large enough to keep the difference between straight cut sheets to an acceptable minimum, and this worked out quite satisfactorily in practice. The roof covering is in galvanized steel deck of trough sections with 1-in cork insulation finished with mineralised roofing felt.

The other large single area – the composition block – is 192 ft. 0 in. wide (comprising two 96 ft. 0 in. span lattice girders) by 228 ft. 0 in. long. It, too, is entirely steel framed. There are 38 girders at 12 ft. 0 in. centres, each weighing 3 tons. A plate girder, or welded construction, 85 ft. 0 in. long by 6 ft. 6 in. deep, weighing approximately 12 tons was delivered by road in one piece.

Interior of warehouse and machine block. Note the steelwork for the curved roof

This building did not present so many design problems and as the use of diagonal truss members was permissible, due to a reduction in the air conditioning services, the normal 'N' truss was used to form a butterfly shape in elevation. The roof covering is similar to the other main production area.

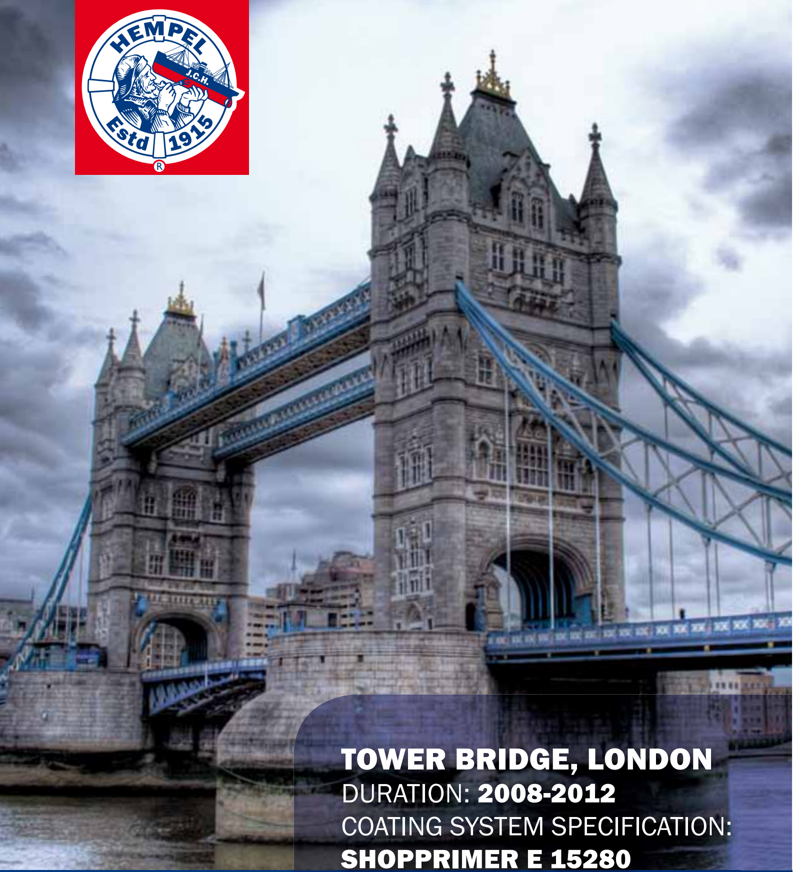
The foundation problems associated with the site were those of a high ground water level and the presence of soft brown clay substrata overlaying gault clay.

The soft brown clay, after analysis, revealed that appreciable settlement was to be expected and it was incapable of sustaining any great load. Consequently, if spread foundations were to be used, they would need to be taken down to below ground water level. This would have involved costly excavation in water and also raised the problem of differential settlement due to the large variation in column loadings.

In view of these difficulties, piled foundations were used in all the buildings.

Architects responsible for the project are Beard, Bennett, Wilkins and Partners; Consulting Engineers, Frederick S. Snow and Partners.

Interior of composition black, showing standard end trusses

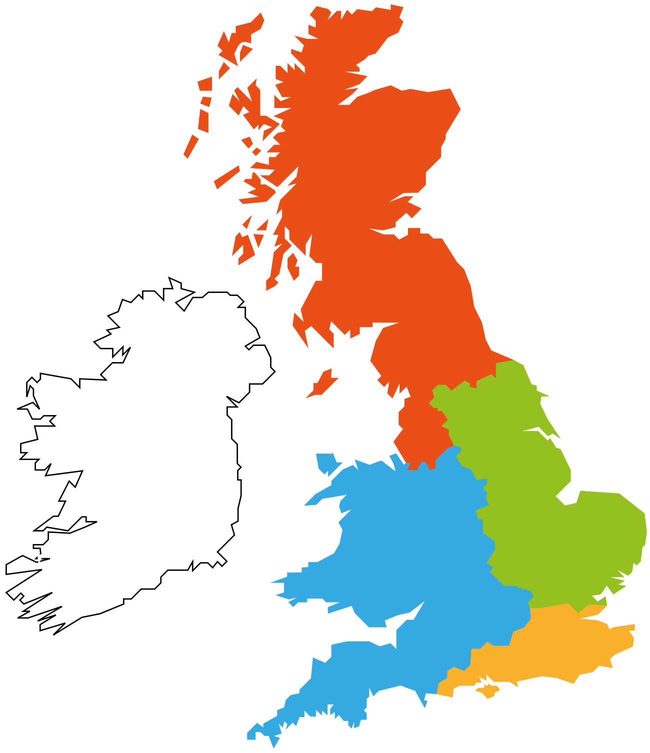


Strength from Advisory Service

Designing and building in steel has never been as straightforward as it is today, and steel still remains the material of choice for construction in the UK. The steel sector provides comprehensive and in-depth technical back up to ensure that those using steel have all the guidance and support they could need at their finger tips.

The co-ordinated and comprehensive support provided by Tata Steel Structural Advisory Service is free of charge to specifiers, clients and designers. Technical experts are on hand to provide an extensive range of services, including design assistance on structural form, performance of steel buildings, seminars and in-house CPD presentations, etc.

If you wish to use any of these services or have an enquiry about steel construction please contact your local representative or the Construction Hotline.



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Steelwork contractors for buildings

BCSA is the national organisation for the steel construction industry.
Membership of BCSA is open to any Steelwork Contractor who has a fabrication facility within the United Kingdom or Republic of Ireland.
Details of BCSA membership and services can be obtained from

Gillian Mitchell MBE, Deputy Director General, BCSA, 4 Whitehall Court, London SW1A 2ES
Tel: 020 7747 8121 Email: *gillian.mitchell@steelconstruction.org*

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

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

Notes

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

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

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	SCM	Contract Value (1)
A C Bacon Engineering Ltd	01953 850611			●	●		●											Up to £2,000,000
ACL Structures Ltd	01258 456051			●	●	●	●				●				●		Member	Up to £2,000,000
Adey Steel Ltd	01509 556677				●	●	●	●		●	●			●	●		Member	Up to £4,000,000
Adstone Construction Ltd	01905 794561			●	●	●												Up to £1,400,000
Advanced Fabrications Poyle Ltd	01753 531116				●		●	●	●	●	●				●	✓		Up to £400,000
Alex Morton Contracts Ltd	028 9269 2436			●	●	●	●		●	●	●			●	●			Up to £400,000
Angle Ring Company Ltd	0121 557 7241												●					Up to £1,400,000
Apex Steel Structures Ltd	01268 660828				●		●			●	●							Up to £800,000
Arromax Structures Ltd	01623 747466	●		●	●	●	●	●	●	●	●	●						Up to £800,000
ASA Steel Structures Ltd	01782 566366			●	●	●	●			●	●			●	●			Up to £800,000*
ASD Westok Ltd	0113 205 5270												●			✓		Up to £6,000,000
ASME Engineering Ltd	020 8966 7150				●					●	●			●	●	✓		Up to £800,000*
Atlas Ward Structures Ltd	01944 710421		●	●	●	●	●	●	●	●	●	●		●	●	✓	Gold	Above £6,000,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●	●	●							●				Up to £2,000,000
Austin-Divall Fabrications Ltd	01903 721950			●	●		●	●		●	●			●	●			Up to £200,000
B&B Group Ltd	01942 676770			●	●	●	●	●		●	●	●		●		✓		Up to £1,400,000
B D Structures Ltd	01942 817770			●	●	●	●				●	●		●				Up to £400,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●				✓		Up to £1,400,000
Barnshaw Section Benders Ltd	01902 880848												●			✓		Up to £800,000
BHC Ltd	01555 840006	●	●	●	●	●	●							●				Above £6,000,000
Billington Structures Ltd	01226 340666		●	●	●	●	●	●	●	●	●	●		●		✓	Gold	Above £6,000,000
Border Steelwork Structures Ltd	01228 548744			●	●	●	●			●	●				●			Up to £3,000,000
Bourne Construction Engineering Ltd	01202 746666		●	●	●	●	●	●	●	●	●	●	●	●		✓	Gold	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●		●	●	●	●	●	●	●	●			●	●	✓		Up to £3,000,000
Cairnhill Structures Ltd	01236 449393	●			●	●	●	●	●	●	●			●	●	✓	Gold	Up to £2,000,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●	●	●	●	●		●	●	✓	Gold	Up to £6,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	●	●	●		●		✓	Silver	Above £6,000,000
CMF Ltd	020 8844 0940				●		●	●		●	●				●	✓		Up to £6,000,000
Cordell Group Ltd	01642 452406	●			●	●	●	●	●	●	●					✓		Up to £3,000,000
Coventry Construction Ltd	024 7646 4484			●	●	●	●		●	●	●			●	●			Up to £800,000
D H Structures Ltd	01785 246269				●		●				●			●				Up to £40,000
Discain Project Services Ltd	01604 787276				●					●	●				●	✓		Up to £800,000
Duggan Steel Ltd	00 353 29 70072		●	●	●	●	●	●			●					✓		Up to £6,000,000
ECS Engineering Services Ltd	01773 810003	●		●	●	●	●	●	●	●	●			●	●	✓		Up to £2,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●		✓	Silver	Up to £6,000,000
EvadX Ltd	01745 336413			●	●	●	●	●	●	●	●	●				✓	Gold	Up to £3,000,000
Fisher Engineering Ltd	028 6638 8521		●	●	●	●	●	●	●	●	●	●				✓	Gold	Above £6,000,000
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●			●							Up to £3,000,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●				Up to £800,000
Graham Wood Structural Ltd	01903 755991		●	●	●	●	●	●	●	●	●	●		●			Silver	Up to £6,000,000
Grays Engineering (Contracts) Ltd	01375 372411				●	●		●		●	●				●			Up to £100,000
Gregg & Patterson (Engineers) Ltd	028 9061 8131			●	●	●	●	●				●		●		✓		Up to £3,000,000
H Young Structures Ltd	01953 601881			●	●	●	●	●			●						Member	Up to £2,000,000
Had Fab Ltd	01875 611711				●				●	●	●				●	✓		Up to £2,000,000
Hambleton Steel Ltd	01748 810598		●	●	●	●	●	●				●		●		✓	Silver	Up to £6,000,000
Harry Marsh (Engineers) Ltd	0191 510 9797			●	●	●	●				●	●				✓		Up to £2,000,000
Henry Smith (Constructional Engineers) Ltd	01606 592121			●	●	●	●	●										Up to £3,000,000
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●			Up to £3,000,000
Hillcrest Fabrications Ltd	01283 212720				●			●							●			Up to £400,000
Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	SCM	Contract Value (1)

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	SCM	Contract Value (1)
Hills of Shoeburyness Ltd	01702 296321									●	●				●			Up to £1,400,000
J Robertson & Co Ltd	01255 672855									●	●				●			Up to £200,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●					●		●				Up to £6,000,000*
Kiernan Structural Steel Ltd	00 353 43 334 1445			●	●	●	●	●	●	●	●	●		●	●	✓	● (orange)	Up to £4,000,000
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●						● (green)	Up to £2,000,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●				●	✓		Up to £3,000,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●			Up to £1,400,000
Mabey Bridge Ltd	01291 623801	●	●	●	●	●	●	●	●	●	●	●	●	●		✓	● (orange)	Above £6,000,000
Mackay Steelwork & Cladding Ltd	01862 843910			●	●		●			●	●			●	●	✓		Up to £800,000
Maldon Marine Ltd	01621 859000				●			●	●	●					●			Up to £1,400,000
Mifflin Construction Ltd	01568 613311		●	●	●	●	●				●							Up to £3,000,000
Newbridge Engineering Ltd	01429 866722			●	●	●	●								●	✓		Up to £1,400,000
Nusteel Structures Ltd	01303 268112						●	●	●	●						✓		Up to £4,000,000
On Site Services (Gravesend) Ltd	01474 321552				●		●	●		●	●				●			Up to £200,000
Overdale Construction Services Ltd	01656 729229			●	●		●	●			●				●			Up to £400,000
Paddy Wall & Sons	00 353 51 420 515			●	●	●	●	●	●	●	●							Up to £6,000,000
Painter Brothers Ltd	01432 374400								●		●				●	✓	● (grey)	Up to £6,000,000
Pencro Structural Engineering Ltd	028 9335 2886			●	●	●	●	●	●		●			●	●	✓		Up to £2,000,000
Peter Marshall Steel Stairs Ltd	0113 307 6730									●					●			Above £6,000,000*
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●			Up to £1,400,000
REIDsteel	01202 483333		●	●	●	●	●	●	●	●	●	●		●				Up to £6,000,000
Rippin Ltd	01383 518610			●	●	●	●	●										Up to £1,400,000
Rowecord Engineering Ltd	01633 250511	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✓	● (orange)	Above £6,000,000
Rowen Structures Ltd	01773 860086		●	●	●	●	●	●	●	●	●	●		●				Above £6,000,000*
S H Structures Ltd	01977 681931						●	●	●	●						✓	● (grey)	Up to £3,000,000
Severfield-Rowen Structures Ltd	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✓	● (orange)	Above £6,000,000
Shipley Fabrications Ltd	01400 231115			●	●	●	●		●	●	●			●	●			Up to £1,400,000
SIAC Butlers Steel Ltd	00 353 57 862 3305		●	●	●	●	●	●	●		●	●				✓	● (green)	Above £6,000,000
SIAC Tetbury Steel Ltd	01666 502792			●	●	●	●				●	●				✓	● (grey)	Up to £3,000,000
Snashall Steel Fabrications Co Ltd	01300 345588			●	●		●								●			Up to £1,400,000
South Durham Structures Ltd	01388 777350			●	●	●				●	●	●			●			Up to £800,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●				●	●			●			Up to £200,000
The AA Group Ltd	01695 50123			●	●	●	●			●	●	●		●	●		● (grey)	Up to £4,000,000*
Traditional Structures Ltd	01922 414172		●	●	●	●	●	●	●		●	●		●		✓	● (grey)	Up to £2,000,000
Tubecon AESS	01226 345261						●	●	●	●				●	●	✓		Above £6,000,000*
W & H Steel & Roofing Systems Ltd	00 353 56 444 1855			●	●	●	●	●						●	●		● (orange)	Up to £4,000,000
W I G Engineering Ltd	01869 320515				●					●					●			Up to £200,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✓		Up to £6,000,000
Watson Steel Structures Ltd	01204 699999	●	●	●	●	●	●	●	●	●	●	●		●	●	✓	● (orange)	Above £6,000,000
Westbury Park Engineering Ltd	01373 825500	●			●		●	●	●	●	●				●	✓		Up to £800,000
William Haley Engineering Ltd	01278 760591			●	●	●			●	●	●					✓	● (grey)	Up to £2,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●		●		✓	● (orange)	Above £6,000,000
Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	SCM	Contract Value (1)

Corporate Members

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

Company name	Tel
Balfour Beatty Utility Solutions Ltd	01332 661491
Griffiths & Armour	0151 236 5656
Highways Agency	08457 504030
Kier Construction Ltd	01767 640111
Roger Pope Associates	01752 263636
Sandberg LLP	020 7565 7000
SUM Ltd	0113 242 7390

Associate Members

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

1 Structural components
2 Computer software
3 Design services
4 Steel producers
5 Manufacturing equipment
6 Protective systems
7 Safety systems
8 Steel stockholders
9 Structural fasteners
SCM Steel Construction Sustainability Charter
(gold) = Gold, (silver) = Silver, (green) = Member

Company name	Tel	1	2	3	4	5	6	7	8	9	SCM
AceCad Software Ltd	01332 545800		●								
Albion Sections Ltd	0121 553 1877	●									
Andrews Fasteners Ltd	0113 246 9992									●	
ArcelorMittal Distribution – Birkenhead	0151 647 4221								●		
ArcelorMittal Distribution – Bristol	01454 311442								●		
ArcelorMittal Distribution – South Wales	01633 627890								●		
ArcelorMittal Distribution – Scunthorpe	01724 810810								●		
ASD metal services	0113 254 0711									●	
Austin Trumanns Steel Ltd	0161 866 0266								●		
Ayrshire Metal Products (Daventry) Ltd	01327 300990	●									
BAPP Group Ltd	01226 383824									●	
Barnshaw Plate Bending Centre Ltd	0161 320 9696	●									
Barrett Steel Ltd	01274 682281								●		
BW Industries Ltd	01262 400088	●									
Cellbeam Ltd	01937 840600	●									
Cellshield Ltd	01937 840600							●			
CMC (UK) Ltd	029 2089 5260								●		
Composite Profiles UK Ltd	01202 659237	●									
Computer Services Consultants (UK) Ltd	0113 239 3000		●								
Cooper & Turner Ltd	0114 256 0057									●	
Cutmaster Machines UK Ltd	01226 707865					●					
Daver Steels Ltd	0114 261 1999	●									
Development Design Detailing Services Ltd	01204 396606			●							
Easi-edge Ltd	01777 870901							●			Gold
Fabsec Ltd	0845 094 2530	●									
FabTrol Systems UK Ltd	01274 590865		●								
Ficep (UK) Ltd	01924 223530					●					
FLI Structures	01452 722200	●									Silver

Steelwork contractors for bridgework

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

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

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

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

BCSA steelwork contractor member	Tel	FG	PG	TW	BA	CM	MB	RF	AS	QM	NHSS 19A	NHSS 20	SCM	Contract Value (1)
B&B Bridges Ltd	01942 676770	●	●	●	●	●	●	●	●	✓				Up to £1,400,000
Briton Fabricators Ltd	0115 963 2901	●	●	●	●	●	●	●	●	✓		✓		Up to £3,000,000
Cairnhill Structures Ltd	01236 449393	●	●	●	●			●	●	✓			Gold	Up to £2,000,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	✓	✓		Silver	Above £6,000,000
Four-Tees Engineers Ltd	01489 885899	●	●	●	●		●	●	●	✓		✓	Member	Up to £2,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445	●	●	●	●			●	●	✓			Gold	Up to £800,000
Mabey Bridge Ltd	01291 623801	●	●	●	●	●	●	●	●	✓	✓	✓	Gold	Above £6,000,000
Nusteel Structures Ltd	01303 268112	●	●	●	●	●		●	●	✓	✓	✓		Up to £4,000,000
Painter Brothers Ltd	01432 374400	●		●					●	✓			Silver	Up to £6.000,000
Rowecord Engineering Ltd	01633 250511	●	●	●	●	●	●	●	●	✓	✓	✓	Gold	Above £6,000,000
S H Structures Ltd	01977 681931	●		●	●	●			●	✓			Silver	Up to £3,000,000
SIAC Butlers Steel Ltd	00 353 57 862 3305	●	●	●	●	●		●	●	✓			Member	Above £6,000,000
TEMA Engineering Ltd	029 2034 4556	●	●	●	●	●	●	●	●	✓				Up to £1,400,000*
Varley & Gulliver Ltd	0121 773 2441	●						●	●	✓		✓		Up to £4,000,000
Watson Steel Structures Ltd	01204 699999	●	●	●	●	●	●	●	●	✓		✓	Gold	Above £6,000,000
Non-BCSA member														
ABC Bridges Ltd	0845 0603222	●								✓				Up to £100,000
A G Brown Ltd	01592 630003	●						●	●	✓				Up to £400,000
Allerton Steel Ltd	01609 774471	●	●	●	●	●	●	●	●	✓				Up to £1,400,000
Cimolai Spa	01223 350876	●	●	●	●	●	●			✓				Above £6,000,000
Concrete & Timber Services Ltd	01484 606416	●	●	●		●	●		●	✓			Member	Up to £800,000
Donyal Engineering Ltd	01207 270909	●						●	●	✓	✓	✓	Member	Up to £1,400,000
Francis & Lewis International Ltd	01452 722200							●	●	✓			Silver	Up to £2,000,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456	●	●	●	●	●		●	●	✓				Up to £2,000,000
Hollandia BV	00 31 180 540540	●	●	●	●	●	●	●	●	✓				Above £6,000,000
Interserve Construction Ltd	0121 344 4888							●	●	✓				Above £6,000,000*
Interserve Construction Ltd	020 8311 5500	●	●	●	●		●	●	●	✓				Above £6,000,000*
Millar Callaghan Engineering Services Ltd	01294 217711	●						●		✓				Up to £800,000
P C Richardson & Co (Middlesbrough) Ltd	01642 714791	●						●	●	✓				Up to £3,000,000
The Lanarkshire Welding Company Ltd	01698 264271	●	●	●	●	●	●	●	●	✓			Member	Up to £2,000,000

Company name	Tel	1	2	3	4	5	6	7	8	9	SCM
Forward Protective Coatings Ltd	01623 748323						●				
Graitec UK Ltd	0844 543 888		●								
Hadley Rolled Products Ltd	0121 555 1342	●									● (grey)
Hempel UK Ltd	01633 874024						●				
Hi-Span Ltd	01953 603081	●									● (green)
Highland Metals Ltd	01343 548855						●				
Hilti (GB) Ltd	0800 886100									●	
International Paint Ltd	0191 469 6111						●				● (orange)
Jack Tighe Ltd	01302 880360						●				
Jamestown Cladding and Profiling	00 353 45 434288	●									
Jotun Paints (Europe) Ltd	01724 400000						●				
Kaltenbach Ltd	01234 213201					●					
Kingspan Structural Products	01944 712000	●									● (orange)
Leighs Paints	01204 521771						●				● (grey)
Lindapter International	01274 521444									●	
Metsec plc	0121 601 6000	●									● (orange)
MSW	0115 946 2316	●									
National Tube Stockholders Ltd	01845 577440								●		
Northern Steel Decking Ltd	01909 550054	●									

Company name	Tel	1	2	3	4	5	6	7	8	9	SCM
Panels & Profiles	0845 308 8330	●									
John Parker & Sons Ltd	01227 783200								●	●	
Peddinghaus Corporation UK Ltd	01952 200377					●					
Peddinghaus Corporation UK Ltd	00 353 87 2577 884					●					
PPG Performance Coatings UK Ltd	01773 814520						●				
Prodeck-Fixing Ltd	01278 780586	●									
Rainham Steel Co Ltd	01708 522311								●		
Richard Lees Steel Decking Ltd	01335 300999	●									● (grey)
Structural Metal Decks Ltd	01202 718898	●									● (green)
Studwelders Composite Floor Decks Ltd	01291 626048	●									
Tata Steel	01724 404040				●						
Tata Steel Distribution (UK & Ireland)	01902 484100								●		
Tata Steel Service Centres Ireland	028 9266 0747								●		
Tata Steel Service Centre Dublin	00 353 1 405 0300								●		
Tata Steel Tubes	01536 402121				●						
Tekla (UK) Ltd	0113 307 1200		●								
Tension Control Bolts Ltd	01948 667700						●			●	
Wedge Group Galvanizing Ltd	01909 486384						●				