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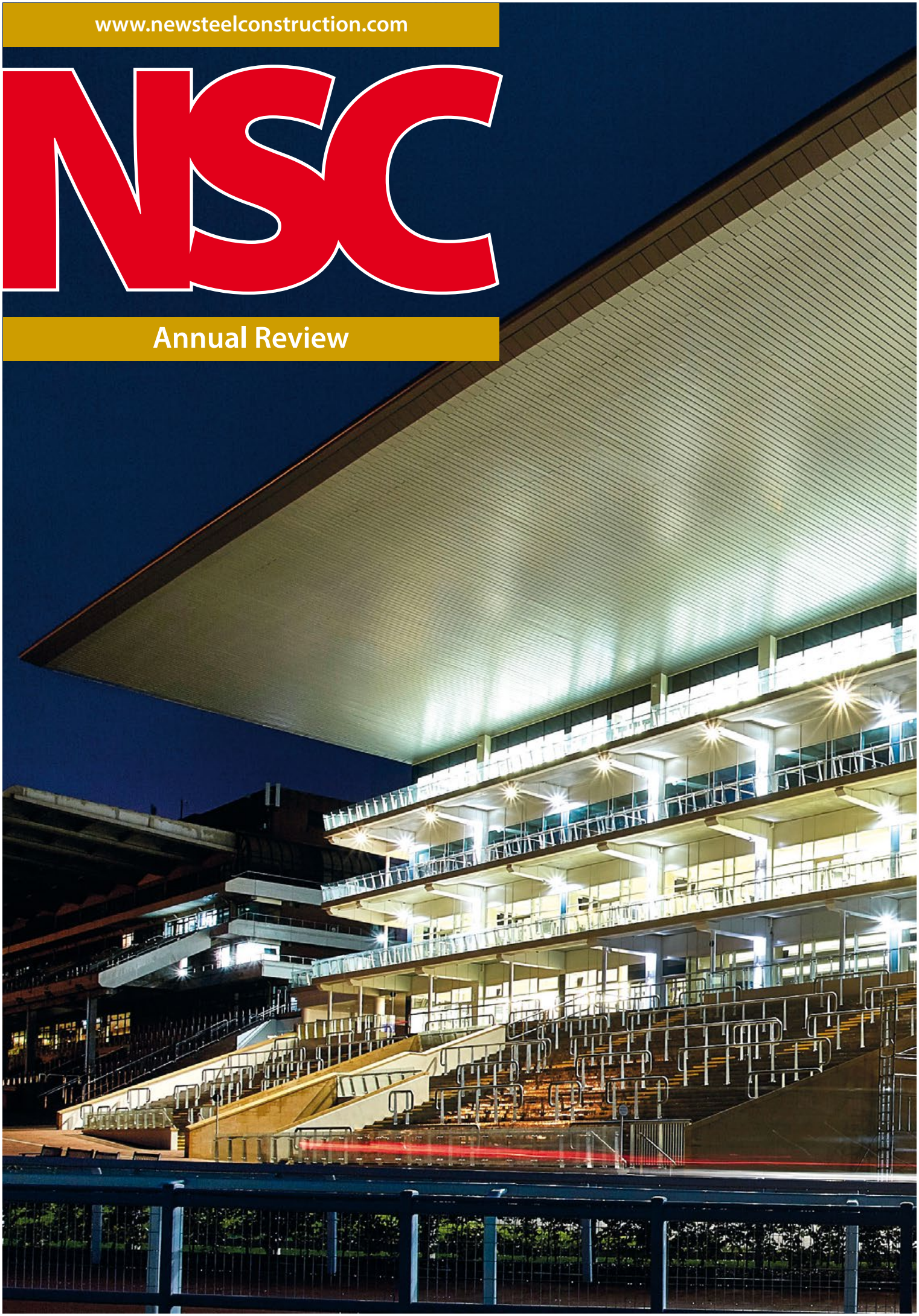
# NSC

## Annual Review



**Cover Image**
**Cheltenham Racecourse Grandstand**
**Main client:** The Jockey Club
**Architect:** Roberts Limbrick Architects
**Main contractor:** Kier Construction
**Structural engineer:** Furness Partnership
**Steelwork contractor:** Hambleton Steel
**Steel tonnage:** 1,660t

Martin Cleveland Photography

# NSC Annual Review



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

# UK steel a world leader on level playing fields

## Introduction by Sarah McCann-Bartlett, Director General of the British Constructional Steelwork Association.

UK steel construction had a successful year in 2015. Most of the steel related publicity during the year concerned the problems that the world's steel manufacturers are struggling to solve, and it is encouraging that we are at last seeing recognition from the UK government that manufacturers across a range of key industries like steel need support in the face of high energy prices, carbon taxes and unfair overseas competition.

Steelwork contractors give their full support to steel manufacturers in their efforts to combat dumping of steel in the UK by overseas producers and to ensure level playing fields in energy costs and carbon taxes.

The UK has an efficient steel distribution sector that services the structural steelwork sector well with a balance of UK and imported steels. UK steel distributors hold high levels of stock and a wide range of products for all construction and infrastructure end uses. Tata Steel has reassured customers that supply of steel sections is unaffected by the mothballing and plant closures announced in October.

2015 was a year of achievement for steel construction on many fronts as we see every month in New Steel Construction.

This review of NSC in 2015 shows the range of outstanding projects that are routinely delivered using steel, which year after year proves to be the most cost-effective and sustainable framing solution.

Some 98% of the structural steelwork used in the UK is fabricated here, mostly by members of the BCSA. Main contractors and clients clearly have a strongly justified confidence in this supply chain's ability to deliver the highest quality, cost-effective product to programme.

Many benefits flow from using a UK-based steelwork contractor, including shorter lead times, contractual security, world class quality design work, improved logistics on site and a health and safety record that is the envy of the construction industry.

A technically sophisticated and efficient industry like this has nothing to fear from overseas competition – always assuming level playing fields of course.

NSC

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# Steel to kick-start Manchester and Salford regeneration scheme

On the site of the former Manchester Exchange railway station, famous for having the world's longest platform, a multi-million pound regeneration scheme is about to reinvigorate the boundary between the north-west's twin cities of Manchester and Salford.

Known as Greengate Embankment, the scheme centres on the old station and Manchester Cathedral and will ultimately deliver a host of retail, commercial and residential buildings, alongside new public realms and a new footbridge spanning the River Irwell.

One of the first parts of the project to get under way is a three-storey steel-framed car park constructed within the footprint of the old Exchange station and adjacent 12-storey steel-framed Grade A office development.

Steelwork erection began in April and Elland Steel Structures will fabricate, supply and erect approximately 3,000t of steel for the project.

Greengate Embankment is a joint development between Ask Developments and Network Rail that will regenerate a long-neglected and underused site into a vibrant new residential, retail and business destination right in the centre of two cities.

# Third steel tower planned for Birmingham's Snowhill

Developer Ballymore Properties has applied for detailed planning consent for an £80M steel-framed office building in central Birmingham to complete its trio of steel Snowhill development towers.

Designed by Sidell Gibson Architects, the 17-storey Three Snowhill replaces proposals for a 43-storey residential tower and adjacent 23-storey hotel, whose construction started but was halted in 2010.

The building would provide 33,500m² of B1 office space and 1,400m² of leisure and conference facilities.

Construction will reuse part of the aborted residential and hotel scheme, including three levels of basement car parking and the ground floor conference area.

Structural cores for the earlier project had been built to fourth floor level but have now been demolished. The steel frame of the new building will punch through into new foundations, enabling existing structures to be reused.

"The development will provide high quality office space and will put the last piece of the Snowhill jigsaw in place, both architecturally and in terms of the business and employment community that is taking shape in this part of the city," said Ron Sidell of Sidell Gibson.

"Reusing part of the scheme that was aborted owing to the effects of the global financial crisis will ensure a more sustainable approach, one which will also reduce the disruptive effects of the construction phase of the proposed project," he added.

Subject to consent, the development will start on site soon and is expected to be completed in the third quarter of 2017.

Opened in 2013, steel for Two Snowhill was erected by Caunton Engineering and the steel-framed One Snowhill was in completed in 2010.

# Plans for 40-storey high City of London steel tower unveiled

Mitsubishi Estate Company (MEC) London has unveiled plans for a new 40-storey skyscraper to be built in the heart of the City's insurance district.

The Japanese investor, which has appointed Stanhope as development manager on the project, will shortly submit an application for the office building on the site currently occupying 6-8 Bishopsgate and 150 Leadenhall Street.

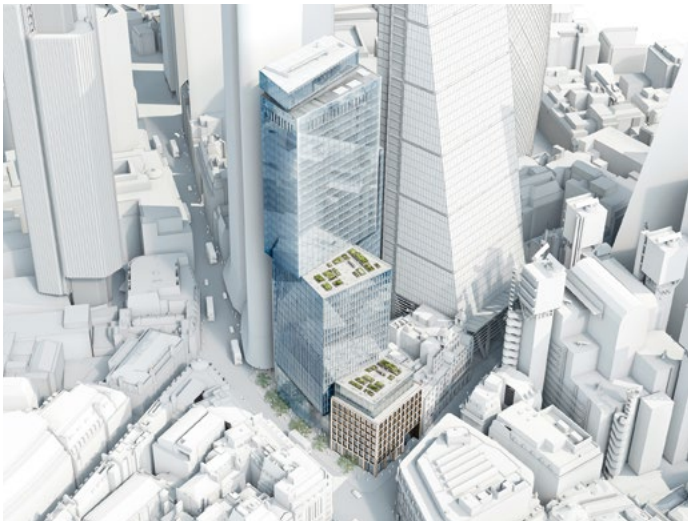
The Wilkinson Eyre-designed building will boast a 71,500m² gross area, including a public viewing gallery at level 40 and ground floor shops and restaurants.

The steel-framed design features a series of stacked blocks which taper as they rise.

Leases in the existing buildings expire at the end of this year, paving the way for a potential start on site in 2016, subject to planning.

The scheme is sandwiched in-between British Land's and Oxford Properties' completed Cheesegrater and the vacant 22 Bishopsgate site, where an Axa-led consortium will shortly submit plans for a new scheme to replace what would have been the Pinnacle.

MEC London Chief Executive Naoki Umeda said: "The submission of this application represents Mitsubishi Estate's confidence in the City's long-term growth prospects as a world financial centre, and its attractiveness for companies."



# Steel supports power station project

Steel contractor Adey Steel will soon begin work to fabricate and install more than 700t of façade retention steelwork at Lots Road power station in Chelsea, London.

Built in 1904 the iconic riverside site has remained unused since its decommissioning in 2002. Developers will soon begin building 706 homes on the eight-acre site including two towers, one of which will be 37 storeys high.

The steelwork will comprise three core towers along the length of the interior of the building, each tower will have multiple 'branches' at four levels reaching out to support ring beams fixed to the interior walls.

These temporary structures will remain in place during strip out of the existing steelwork and until a replacement steel frame to suit the building's new use is erected.

The project is said to be challenging due to the scale of the existing building and the legacy of basements and pits in the internal floor.

The 100-year old steelwork from the original build needs to be negotiated as the new supporting steel is erected; as a result crane and access equipment has been tailored to suit these limiting conditions.

Adey Steel Operations Director Ross Brown commented: "This is a landmark project for us, to be involved in one of the largest façade retention schemes in London to date is testament to our business. We have been working hard with our client studying the design solutions for the project ensuring best value and buildability, and we now look forward to the project getting under way."

# Lincoln transport hub will be driven by steel

A £29M scheme that will improve Lincoln's transport infrastructure and modernise its city centre will be constructed predominantly with structural steelwork.

The Lincoln transport hub project will see main contractor Willmott Dixon construct a new bus station, improve the current train station, create a dual-purpose footbridge to link St Mary's Street and Tentercroft Street and deliver a 1,000 space multi-storey car park.

It is expected that the steel-framed bus station, which will replace an outdated facility, will start on site early this year, around the same time as the steel composite footbridge is due to be erected.

The steel-framed car park will require approximately 1,200 tonnes of steel and will form one of the final pieces of the scheme with work due to begin in 2017. All of the steelwork packages for the Lincoln hub are currently out to tender.

Cllr Colin Davie, Executive Member for Economic Development at Lincolnshire County Council, said: "This project, along with the major road improvements being made by the county council, will ensure that the city remains well-placed for business growth over the coming years."

David Reid, operations manager at Willmott Dixon said: "This is a huge step forward in the council's ambitions for an integrated transport system which will transform and improve the first impressions for visitors and pedestrian connectivity to this great historical city."

# Commercial development spearheads regeneration

The £11M steel-framed Tower Wharf office development, that forms one of the initial phases of the Wirral Waters Enterprise Zone in Birkenhead, has been completed.

The BREEAM 'Excellent' four-storey building provides 4,450m² of flexible Grade A open plan office space.

The Enterprise Zone is being developed by Longmeadow Estates and it will eventually transform more than 500 acres of Birkenhead's former docks into a new business and leisure destination.

"This project will deliver much needed accommodation and employment opportunities for a scheme which will boost business and generate investment into the area," said Eric Wright Construction's Operations Director Jonathon Rayner.

Leach Structural Steelwork has erected a total of 375t of steel for the project.

## NEWS IN BRIEF

A new off-the-shelf Adjustable Lifting Point (ALP) from **Lindapter** is said to be suitable for rigging and lifting up to three metric tonnes at an angle +/- 18°. The assembly includes four M12 Type AAF clamps that self-adjust to suit flange thicknesses from 5mm up to 26mm.

A new and updated version of Tedds, the software for automating repetitive civil and structural calculations for engineers, has been launched by **Tekla**. New features allow engineers to better analyse and design beams to Eurocode, the harmonised technical rules developed by the European Committee for Standardisation for the structural design of construction works in the European Union.

**StruMIS** has released its BIMReview V8, a collaborative Building Information Modelling (BIM) project review tool for use across construction projects. The company says it is a low cost, feature rich tool, to import BIM models and associated data from multiple CAD authoring tools to consolidate effective review and visual communication.

**Wessex Galvanizers** (part of the Wedge Group) is playing an important part in the ongoing restoration of the fire-stricken Hastings pier. The company has provided its hot-dip galvanizing protection to over 250t of steel used to fabricate components of the new pier structure.

The steel-framed Exhibition Centre Liverpool (ECL) opened its doors for the first time in September by hosting Wound Expo 2015, the exhibition for nurses. Situated on the city's riverfront, the ECL is connected by a bridge to the ACC Liverpool. Working on behalf of main contractor ISG, **Billington Structures** fabricated, supplied and erected 2,000t of steelwork for the ECL.

# BCSA awards first fabricator-welder certificate

The first British Constructional Steelwork Association (BCSA) CRAFT Structural Steelwork Fabricator-Welder Certificate has been awarded to Billington Structures' Alex Shaw.

Mr Shaw completed the training modules with the assistance of coaches from within his workplace. The monitoring of the training and final confirmation of the different modules' tests was validated by the BCSA Registered Validator, Jon Wright, who is also the Workshop Supervisor and Responsible Welding Coordinator for Billington Structures at its Wombwell facility.

BCSA Director of Health, Safety and Training Peter Walker said "I am pleased that the first CRAFT Structural Steelwork Fabricator-Welder certificate has been awarded to Alex as he and Jon have been actively involved in the content of the training modules, and their suggestions have contributed to the development of the CRAFT Apprentice Scheme.


*Left to right: Jon Wright, Billington Structures; Alex Shaw, Billington Structures; Peter Walker, BCSA and Darren Kemplay, Billington Structures*

"Credit also goes to Darren Kemplay, Billington Structures' Group HR Manager for coordinating the successful liaison between those busy working in a production environment and the BCSA, which enabled the successful piloting of the first CRAFT Structural Steelwork Fabricator-Welder Apprenticeship."

In order to combat a possible skills shortage in the steel construction sector, BCSA members are actively taking on apprentices, and the BCSA, together with its members, has developed an industry specific apprenticeship training scheme that is called CRAFT (Competence Route of Attainment in a Fabrication Trade).

# UK structural steelwork supply assured

The structural steelwork sector is in good health and remains on a growth path that will not be affected by the recently announced problems affecting some steel making in the UK.

Tata Steel and other steel manufacturers have announced plans for scaling back production of some products, with some plant being mothballed, in the face of a range of pressures including imports of steel from China, a high Sterling exchange rate and internationally uncompetitive carbon related taxes. The British Constructional Steelwork Association has responded to reassure the market that there will be no impact on the supply or availability of steelwork.

BCSA Director General Sarah McCann-Bartlett (pictured) says the UK's structural steelwork sector already uses a mix of high quality domestic and imported steel. "We have a well developed and highly efficient steel stockholding and distribution sector that supplies steelwork contractors with a balance of UK and imported steels.

"There are high levels of stocks that can quickly and easily be expanded if required. Tata Steel has confirmed that despite scaling down some operations at Scunthorpe and in Scotland, production of the steel sections that we use for structures is unaffected by any of this."

SSI and Caparo, which have both gone into administration, did not supply steel to the UK's structural steelwork sector.

BCSA says its forecast for growth in the structural steelwork fabrication market of 5% in 2015 and 2% in 2016 remains unaltered and steel-framed buildings are still 5% cheaper than concrete alternatives according to the latest cost analysis by Gardiner & Theobald.

Ms McCann-Bartlett said: "While these growth forecasts meet demand for current and planned construction and infrastructure projects, UK steelwork contractors also have the ability to increase output should demand for structural steelwork increase further.

"Structural steelwork consumption in the UK remains below the long-term average of 1 million tonnes per annum at 862,000 tonnes. But at its peak, UK structural steelwork consumption reached 1,400,000 tonnes, so there is still latent capacity in the sector."

BCSA says it fully supports the steel manufacturing industry's calls for a level playing field for UK steel manufacturing.

Ms McCann-Bartlett said: "A UK supply of high quality steel creates a competitive and efficient market, and importantly supports the UK economy and UK jobs."

# East Anglia's largest potato store built with steel

A steel frame, erected by A C Bacon Engineering, has helped create what is said to be the largest potato store in East Anglia.

The box potato store and grading area is located at Sutton Gault, near Ely and is owned by P J Lee & Sons.

Built on the site of a former machinery storage area, the state-of-the-art building was delivered on time and on budget by a team led by main contractor Thurlow Nunn Standen, with A C Bacon providing the steelwork, cladding and access doors.

Insulation and ventilation are key to maintaining cool temperatures which are needed during the crop storage season.

The building can be segregated into eight storage areas, each with the ability to maintain its own climate requirements. The introduction of a 250kW solar photo-voltaic system on the roof also contributes, not only to the running of the store, but also the whole site during peak production.

Twenty four lights in the 26m x 58m central grading area ensure effective grading of crop. The grading area can be converted into another storage area for a further 2040 boxes after grading has completed.

A set of 24m wide 'hangar' doors provide safe, efficient, unhindered access to the central hub from which all of the eight storage areas can be serviced.

# Bomber Command memorial unveiled

A 31m-high weathering steel spire commemorating those who served with Bomber Command during the Second World War has been officially unveiled.

Forming the first phase of the International Bomber Command Centre (IBCC) in Lincoln, the steel structure is said to represent wing fragments. Its height is the same as the wingspan of a Lancaster Bomber; its base at 5m wide is the same width as a Lancaster's wing.

Place Architecture won the design competition for the Spire and Project Architect Stephen Palmer says the brief was for a contemporary memorial.

"By using weathering steel we fulfilled the brief, but we also created a multi-layered sculpture that references flight, aircraft manufacture and is also a nod to nearby Lincoln Cathedral," says Mr Palmer.

"Weathering steel also allowed us to design a sculpture with an organic feel and one that has a changing hue, which is ideal for its countryside setting."

S H Structures fabricated the structure from 32 rolled weathering steel plates. Perforated panels, again reflecting the engineering principles used in airframe construction connect the external plates.

Built in jigs to maintain the shape during welding, the structure was fabricated in two sections – upper and lower parts - with sacrificial lifting frames to aid installation.

Further work will soon begin at the IBCC with the construction of a steel-framed visitor centre (known as the Chadwick Centre).

This will comprise an exhibition hall that will tell the story of Bomber Command through a multi-media experience, an education facility and a comprehensive multi-layered digital archive.

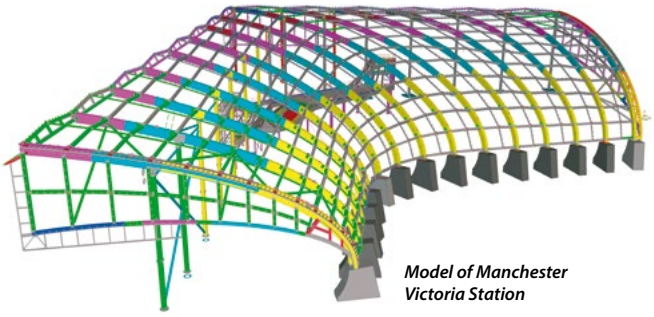
# Steel successes at 2015 UK Tekla Model Competition

Steelwork contractors have won six categories - BIM Project, Engineering, Engineering (Analysis & Design), Steel, Miscellaneous and The People's Choice at the 10th annual UK Tekla Model Awards.

The Tekla Awards focus on projects of all shapes and sizes, which have used Tekla software as part of the process for designing and modelling structures, or where the use of Tekla software has aided collaboration.

Tekla Managing Director Andrew Bellerby said: "Once again our model competition has yielded some fabulous projects where the use of 3D modelling software has revolutionised the design, planning and delivery."

Expert judges from the construction industry consisted of Jason Underwood from the University of Salford; Mark Crowe, BIM Academy; Richard Ogden, Build Offsite; Jonathon Lock from AECOM; Rob Jackson at Bond Byron Associates and Greg Cork from AEC magazine.



*Model of Manchester Victoria Station*

The steel sector winners were:

- Total BIM projects - Manchester Victoria Station, Severfield
- Steel - Leeds Station, William Hare
- Engineering - The Curve, Caunton Engineering
- Engineering (A&D) - 1 Bond Street, Caunton Engineering
- Miscellaneous - Bloomberg Ramp,
- The People's Choice - Manchester Victoria Station, Severfield

# Shear connection rules to Eurocode 4 published by SCI

Steel Construction Institute (SCI) has published 'Minimum degree of shear connection rules for UK construction to Eurocode 4', guidance that was produced with British Constructional Steelwork Association (BCSA) and Tata Steel funding.

The downloadable publication is available on www.steelconstruction.info and www.steelbiz.org for registered users who are members of either SCI or BCSA.

"For many years composite construction has played a major role in the commercial success of the steel construction sector in the UK. The rules given in this new publication complement those given in Eurocode 4, and in so doing will enable valid designs to be produced for a broader range of beams," said SCI CEO Graham Couchman.


This publication presents design resistances for shear studs when used in the presence of modern forms of decking. It includes rules for the minimum number of studs that are needed on a range of beams (the minimum degree of shear connection).

In many cases this minimum is lower than would be required by EN 1994-1-1 (and BS 5950-3.1 prior to its amendment in 2010).

The combination of less onerous requirements for minimum degree of shear connection, and lower stud resistances, allows many composite beams to be designed that would not satisfy the rules given in EN 1994-1-1.

## NEWS IN BRIEF

The new **Voortman** V505-160T punching and shearing machine has been designed specifically for the steel fabrication sector and is said to offer high-speed processing and less wastage. The time required to complete a full production cycle is shortened by up to 25% in comparison to equivalent punching and shearing machines according to Voortman.

The first phase of the ambitious Inverness Campus development has been officially completed with the opening of the new Inverness College. The new steel-framed building, erected by **BHC**, will act as a focal point for the entire Campus as it is by far the largest single structure in the development. Spread over three-storeys, the building offers more than 20,000m² of teaching and workshop space for some 6,500 students.

**Hambleton Steel** says it has increased fabrication efficiency and streamlined material flow after installing a new Voortman integrated process line at its main Rotherham fabrication facility. Utilising an area in the factory with a lower floor level and formerly used for painting and dispatch, the installation required Hambleton to erect a new 2m-high steel floor covering 1,500m².

Birmingham's Grand Central shopping complex, which forms an integral part of the £750M New Street Station redevelopment, has opened its doors. The complex, which sits above the station's new concourse level, includes one of the UK's largest John Lewis department stores. Working on behalf of main contractor Mace, **Severfield** erected 2,850t of structural steelwork for the four-storey shopping complex project.

Steel construction has played a major role in the building of Swansea University's Bay Campus which opened in September. Built on the site of a former BP facility, the 65-acre Campus development includes seven steel-framed structures. Working on a design and build contract for main contractor Vinci Construction, **Caunton Engineering** was responsible for fabricating, supplying and erecting five of the buildings which required 1,800t of steel.

# Steel awards highlight industry's innovation

**The Structural Steel Design Awards (SSDA) scheme was instituted in 1969 to recognise the high standards of structural and architectural design attainable in the use of steel.**

*Tata Steel Sales and Marketing Director, Peter Hogg*

*Host, Emma Crosby*

*Chairman of the Judges, David Lazenby*

*BCSA President, Wendy Coney*

Five projects were Award winners at last year's Structural Steel Design Awards (SSDA) held on 1st July at One Great George Street, London.

The five winning projects at the 47th annual SSDA were Moorgate Exchange, London; First World War Galleries, Imperial War Museum, London; Derby Arena; Merchant Square Footbridge, London; and Island Pavilion and Footbridge, Wormsley.

From an initial shortlist of 14 projects, all of this year's entries scored highly in efficiency, cost-effectiveness, aesthetics, sustainability and innovation.

Chairman of the Judges, David Lazenby CBE said: "This year it is again evident that all shortlisted projects show merit. There is not one that does not have favourable attributes.

"The spread of the projects, both geographically and in types, demonstrates how steelwork is used successfully in almost any type of project. Bearing in mind the great ingenuity applied by designers and practitioners there are scarcely any limits to the nature of the submissions."

Tata Steel Sales and Marketing Director Peter Hogg expressed his admiration for the UK construction industry's design skills. "There is of course a reason for the UK's world leading position in steel construction and that is your skill as design and construction teams in getting the best out of steel.

"Your expertise shines through the entire shortlist for tonight's awards and I would like to congratulate every one of you for your outstanding achievement. At Tata Steel we have been a part of the success story of the UK supply chain for many years."

Mr Hogg also confirmed Tata Steel's sponsorship of the SSDA for 2016.

British Constructional Steelwork Association President Wendy Coney said: "The whole collection of 14 outstanding projects reflects a construction industry that is vibrant, innovative and really knows how to get the best out of steel - the structural material of choice for the world we live in. The UK is acknowledged as the world leader in the use of steel in construction and these Awards celebrate your undoubted expertise.

"Tonight's event has demonstrated what can be achieved in terms of best practice by the construction industry on both large and small projects. This has once again been an outstanding year and I encourage you to continue the good work and submit your entries for the 48th Awards."

## AWARDS

**Moorgate Exchange, London**

**First World War Galleries, Imperial War Museum, London**

**Derby Arena**

**Merchant Square Footbridge, London**

**Island Pavilion and Footbridge, Wormsley**

## COMMENDATIONS

**Heathrow Terminal 2B**

**Milton Court, Guildhall School of Music and Drama**

**Greenwich Reach Swing Bridge, London**

## CERTIFICATE OF MERIT

**Kew House, Richmond**

**Weathering Steel House, Putney**

## OTHER FINALISTS

**St James's Gateway, London**

**City Centre Bus Station, Stoke-on-Trent**

**Retail Development Plateau, Bargoed**

**Tottenham Hale Bus Station Canopies**

Designed as a large rectangular block which stands out from its more sober looking neighbours, Moorgate Exchange is dominated by an eye-catching angled façade containing stepped gardens on its six upper levels.

With a BREEAM "Excellent" rating, the 18,500m² steel-framed building has uniform, square open plan floorplates arranged around a central atrium and two main cores. The design ensures flexibility, as all of the floors can be subdivided if necessary.

The building's west facing wedge-like form responds to the rights to light of the residents in the Barbican. Its height is limited by the St Paul's viewing corridor and the choice of structural strategy was influenced by the need to avoid conflicts with Crossrail tunnelling that partially overlaps the site's footprint.

The design team used these constraints to achieve a distinct architecture. The wedge has been creatively used to provide landscaped terraces at the upper levels. These are highly visible from the surrounding streets and notionally extend the greenery of the Barbican terraces eastwards.

The building's structural floor zone was designed to be the minimum depth possible in order to accommodate the required services openings, which allowed an additional floor to be introduced at the top of the building.

Project Director for Skanska Richard Norris says: "The relationship between Skanska and Severfield has developed and strengthened over the years because employees from both companies have worked together on previous projects.

"The coordination of the steel structure with the cladding interfaces was a complex and extensive job; however, due to everybody's proactive and positive approach to the challenges involved it was completed successfully."

In summary the Judges say, the team maximised the net lettable space by exploiting the great benefits of a steel frame – long clear spans with minimal fire-engineered columns, and with a reduced overall floor depth that enabled the incorporation of an additional storey.

**FACT FILE**
**Moorgate Exchange, London**
**Architect:** HKR Architects
**Structural engineer:** Ramboll
**Steelwork contractor:** Severfield
**Main contractor:** Skanska UK Ltd
**Client:** Blackrock

Structural steelwork has been used to reinvigorate the world famous Imperial War Museum (IWM), with the construction of new galleries and an atrium adding extra space to exhibit some of its largest items such as a Spitfire, rockets, tanks and other military hardware.

The refurbishment project required the cutting-out and removal of existing concrete floors and steelwork to create an extended atrium space for large hanging exhibits. All materials removed from the building and all new materials brought to site had to pass through a constrained entrance way, which meant they were often man-handled into place as mechanical means was not possible.

The access way into the main atrium was further complicated by having a 90 degree turn from the access way between the existing concrete columns and the atrium space. This limited the new steelwork to a maximum length of approximately 8m.

HRH the Duke of Cambridge and the Prime Minister, David Cameron MP, officially opened the IWM London's new First World War Galleries following the refurbishment in July 2014.

Angular and robust structures frame new galleries and support war machines in a cathedral-like space. Steel construction uniquely allowed constraints of access and time to be well answered, sum up the judges.

**FACT FILE**
**First World War Galleries, Imperial War Museum, London**
**Architect:** Foster + Partners
**Structural engineer:** BuroHappold Engineering
**Steelwork contractor:** Bourne Steel Ltd
**Main contractor:** Lend Lease
**Client:** The Trustees of the Imperial War Museum

**FACT FILE**
**Derby Arena**
**Architect:** FaulknerBrowns
**Structural engineer:** Arup
**Steelwork contractor:** Billington Structures Ltd
**Main contractor:** Bowmer & Kirkland
**Client:** Derby City Council

With a capacity of 5,000 spectators, Derby Arena is a multi-sport venue that has been designed to accommodate a range of sports and community activities.

As well as the 250m Siberian timber Olympic-sized cycling track, the main Arena houses a multi-sport hall which can be configured as 12 badminton courts, three volleyball courts or used for other indoor sports such as five-a-side football.

A key element of the project's innovative design is its first floor level raised track that allows greater flexibility of the infield for other uses, such as events, exhibitions and even concerts.

FaulknerBrowns Director Nigel Tye says: "By using steel we have delivered a complex, innovative and unique multi-sport and event arena facility to a cost-effective budget."


© Bowmer & Kirkland

Summing up, the judges say a very well executed project for a new velodrome that challenges the normal configuration by lifting the track to free-up the ground floor for a multi-use sports facility. The highly efficient steel-framed structure, with its 85m spans, exposes the steelwork where appropriate.

**FACT FILE**
**Merchant Square Footbridge, London**
**Architect:** Knight Architects
**Structural engineer:** AKT II
**Steelwork contractor:** S H Structures Ltd
**Main contractor:** Mace Ltd
**Client:** European Land & Property Ltd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Spanning the Grand Union Canal at Paddington Basin, west London, the Merchant Square Footbridge was conceived by Knight Architects and structural engineers AKT II following a limited design competition in 2012.

Connecting buildings either side of the canal and replacing an existing crossing at a new mixed-use development, the new bridge is 3m wide and spans 20m. It is divided into five slender fingers which are raised using hydraulic jacks with an action similar to that of a traditional Japanese hand fan

Inspiration for the fan-like design came from the desire to have an easy to maintain structure, that would become a landmark.

The erection of this novel structure was solved imaginatively, as were the extreme requirements for accuracy. This is in the tradition of exciting sculptural bridges in steelwork at this development say the judges.

**FACT FILE**
**Island Pavilion and Footbridge, Wormsley**
**Architect:** Robin Snell and Partners
**Structural engineer:** Momentum
**Steelwork contractor:** Sheetfabs (Nottm) Ltd
**Main contractor:** Mace Ltd
**Client:** Wormsley Estate

The Island Pavilion and Footbridge at Wormsley House near High Wycombe is part of a landscape group of pavilions that also includes Garsington Opera House, a project that won an SSDA Commendation in 2012.

The Island Pavilion will be used for entertaining during the summer months of opera, including dining, receptions, art exhibition and musical recitals and has been designed as a container to house a stainless steel sculpture by Jeff Koons entitled 'Cracked Egg (Blue)'.

"The pavilion has been designed as a jewellery box on a lake and a place to enjoy, visit and be entertained," explains architect Robin Snell.

The single-storey pavilion measures approximately 8m by 15m on plan and is 4m high, situated on the east side of the island.

The structure is generally open plan, with cellular accommodation to the rear housing kitchen and washroom facilities. The primary space is a single room with glazed walls. None of the walls contribute to the structural system which allowed the pavilion to be constructed quickly and easily on site.


© Dennis Gilbert

In summary, the judges say the project is a testament to the pursuit of technical refinement when economy is not the key.


## Call for entries for the 2016 Structural Steel Design Awards

Tata Steel and The British Constructional Steelwork Association have pleasure in inviting entries for the 2016 Structural Steel Design Awards.

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

The Awards are open to steel based structures situated in the United Kingdom or overseas that have been built by UK or Irish steelwork contractors using steel predominantly sourced from Tata Steel. They must have been completed and be ready for occupation or use during the calendar years 2014-2015; previous entries are not eligible.

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

**Closing date for entries:**
**Friday 26th February 2016**

BCSA

TATA STEEL


# Lifeboat centre in the frame

**FACT FILE**
Royal National Lifeboat Institution All-weather Lifeboat Centre, Poole
**Main client:** Royal National Lifeboat Institution
**Architect:** Ellis Belk Associates
**Main contractor:** Leadbitter (Bouygues UK)
**Structural engineer:** Ramboll
**Steelwork contractor:** H. Young Structures
**Steel tonnage:** 1,000t

## Steel construction was the only solution to create the Royal National Lifeboat Institution's all-weather maintenance and manufacturing facility. Martin Cooper reports from Poole harbour.

Founded in 1824, the Royal National Lifeboat Institution (RNLI) has the responsibility of keeping the seas around the British Isles safe. Looking after one of the longest coastlines of any European nation is a mammoth task and during its lifetime the RNLI has saved more than 140,000 lives.

The charity has a fleet of 346 lifeboats operating out of 237 lifeboat stations and the nature of the work has meant that it has always been at the forefront of nautical design and development.

However, as the technology used on its lifeboats has advanced in recent times, the pool of suppliers able to produce them to the required exacting specifications has reduced.

The RNLI's solution was to build a world-class centre of excellence in lifeboat engineering, production and manufacture at its headquarters in Poole. Known as the All-Weather Lifeboat Centre (ALC), the facility has brought together the production for the RNLI's new generation of Shannon Class all-weather lifeboats, as well as providing a maintenance and refit facility for its existing Tamar and Severn Class fleet.

The ALC consists of two large steel-framed buildings (A and B), both approximately 85m long × 30m wide, connected by a central covered courtyard.

Long clear spans for the main areas of both buildings were an important part of the design and were the main reason behind the choice of steel as the project's framing material.

"Spans up to 20m, the requirement for various roof curves and the need for the frame to be constructed quickly, meant that a steel-framed structure was the optimum solution," says Ramboll Structural Engineer Ben Punton.

Both buildings' main production areas have been formed around 10m × 20m bays as this provides the necessary open column-free space. A slightly smaller 10m × 8m grid pattern is then used for adjoining mezzanine levels and first floor office areas.

The steel design is a hybrid with portal action providing stability in one direction and diaphragm action, in combination with strategically positioned cross bracing, providing stability in the other direction. Although both buildings are structurally independent, the interconnecting 23m wide canopy also provides some extra stability.

The first part of the lifeboat manufacturing process takes place in building A, where composite hulls, decks and wheelhouses are cast in large moulds. Overhead cranes allow the hulls to be moved around the building as work progresses, while the structure's 20m internal height makes winching the hull out of its mould for the first time a safe and controlled operation.

"The halls in both buildings have been designed around the largest class of lifeboat," says RNLI Project Supervisor Iona Evans. "Building A can accommodate five

Severn Class vessels at one time, while B can house seven."

One end of building A accommodates spray booths, three for the boats themselves, and one smaller booth to be used for painting components. Formed and painted boats will then be transferred across to building B where the engines and wheelhouses will be installed.

Each of the buildings features a mezzanine walkway that runs along one elevation at a 3m high and will allow engineers and technicians to walk straight onto the deck level of lifeboats for maintenance work. Above the mezzanines both buildings have office space, a canteen, and toilets and showers. Building B also has a viewing gallery and "visitor experience" suite with windows looking out over the maintenance and production hall.

Leadbitter, a Bouygues UK company, delivered the new building. Summing up the project, Bouygues UK Senior Project Manager Mike Harrington says: "This is a unique and bespoke project. The timescales for delivering the project and the budget were a challenge initially. However, we've worked hard to build a centre that will serve the RNLI and its staff and volunteers for many years to come."

*The steel frame takes shape*

## Steel erection programme

Steelwork contractor for the project was Norfolk based H. Young Structures. The company fabricated and supplied approximately 1,000t of structural steelwork for the project, with the entire package then erected in a fast-track 12-week programme.

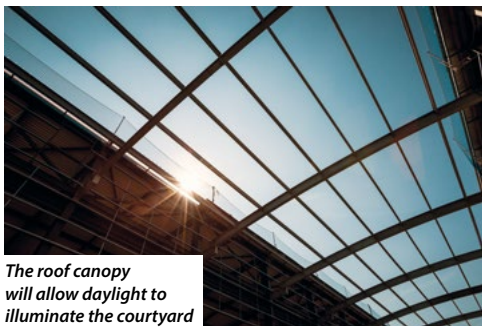
Using Ramboll's original design, H. Young Structures designed all of the connections as well as the secondary steelwork for the envelope support.

"Speed and quality were of the essence as far as getting the steel frame up," explains H. Young Structures Projects Director Peter Smith. "We had two gangs erecting steel simultaneously at one stage."

Steel erection began on building A, with a second gang commencing work on building B five weeks later. As the second building was erected the 25m-long galvanized rafters spaced at 10m intervals, which form the canopy over the central courtyard, were also installed.

Only the main rafters for the canopy were initially erected as this left large enough gaps to allow the cladding system to be installed to the building's inside elevations. Once the main frame steelwork was up and the cladding finished, H. Young Structures completed the installation of canopy purlins on a return visit.

"This has been a prestigious project for us to be involved in," sums up Mr Smith. "We had no access issues erecting the steelwork as we had the site pretty much to ourselves. The biggest challenges were the tight tolerances we were working to around the building's large doorways and the internal crane beams."



*The roof canopy will allow daylight to illuminate the courtyard*

*Steelwork's speed of construction was important to this project*

*The two buildings are connected by a covered courtyard*

*The last steel sections for the roof are lifted into place*

# Steel in the running for grandstand finish

## A new multi-million pound five-storey grandstand is the centrepiece of Cheltenham Racecourse's redevelopment plans. Martin Cooper reports.

*Large bespoke brackets support the balconies*

The four-day Cheltenham Festival that includes the prestigious Gold Cup race is one of the nation's top sporting events with more than 230,000 spectators in attendance and hundreds of millions of pounds gambled every year.

In order to keep the Festival at the forefront of the horseracing calendar The Jockey Club has embarked on a £45M redevelopment of Cheltenham Racecourse with the construction of a new state-of-the-art five-storey 6,500 capacity grandstand.

The overall project will also see the creation of elevated walkways to the rear of the grandstand to ease mobility for spectators and provide a multi-tiered 'amphitheatre' experience around the parade ring, allowing even more people to enjoy the equine stars at the heart of all Cheltenham's race days.

Main contractor Kier Construction started on site in March 2014 straight after that year's Cheltenham Festival had finished. During its time on site Kier will be subject to 12 sectional handovers as various parts of the project are completed.

Working around the Racecourse's calendar has been one of the project team's main challenges. The course remains open throughout the construction programme and this has required the site to be closed down and secured ahead of and during each race meeting.

Although the lower terracing was


Martin Cleveland Photography

## Wind loadings

Cheltenham Racecourse is renowned for its breezy conditions and, as the new grandstand is situated near the top of a slope which culminates with the course's winning post, the structural design has taken strong winds into consideration.

"We looked into the site in great detail with regards to wind so we could accurately assess the impact on the canopy roof structure. Given the aerofoil nature of the roof it was important to have a comprehensive understanding of the magnitude of wind loads, which can be amplified by the roof's own geometry and the physical structure of the building from which it is supported.

"This enabled us to limit any unacceptable deflections, and analyse for unstable oscillatory motions such as flutter or galloping which can be fundamentally detrimental to the structure," says Furness Partnership Director Paul Haines.

used for last year's Festival, the remainder of the grandstand was not complete and consequently it was secured ahead of the meeting.

"Closing the site down for each meeting and especially the Festival, which requires us to prepare the area at least week before the meeting, is certainly a challenge for the team," says Kier Design Manager Andy Bolas. "However, the day after each meeting finishes we are back on site and working normally."

The intermittent racing meetings have not hindered the construction programme. The steel erection for the grandstand was completed last year with Hambleton Steel erecting the last roof and eaves overhang members in February.

Founded on piled foundations, the five-storey steel-framed structure includes a part basement and is predominantly based around an 8m × 11m grid pattern.

"This grid is replicated in the roof structure and also provides the boxes and hospitality areas with large flexible column-free spaces," says Furness Partnership Director Paul Haines.

"Behind this grid line the structure then has a slightly smaller 8m × 5.5m pattern which accommodates the back-of-house areas."

Although it is linked via public access ways to the adjacent stand, the new grandstand is structurally independent and gains all of its stability from a combination of vertical bracing, rigid frame action, and diaphragm action through composite floors.

All of the bracing is located within stair and lift cores that are located in the back-of-house area of the stand. The front grid line is a five-storey, seven bay, rigid frame with full-height glazing to provide unobstructed viewing to race-goers as well as access to the balconies.

Composite construction, utilising metal decking, has been used to construct all of the internal floors; while balconies and terraces are formed with steelwork supporting bespoke reinforced concrete units incorporating viewing steps and a white Dolomite finish.

Initially the structural design was for precast planks to be used internally, but Kier changed the design to composite flooring as this form of construction was preferred for its improved buildability, avoiding craneage issues of the large planks and the formation of works holes and service openings.

The structure's layout consists of basement toilets, ground floor public areas including access to the main terrace, first floor members bars, second floor owners and trainers bars, third floor royal and private boxes, and fourth floor Cheltenham Club premium boxes.

Each of the levels from first floor upwards incorporates a row of balconies giving the adjoining boxes an outside vantage point for the races.

The balconies cantilever out by up to 4m and are all supported by large plate girder brackets bolted to the main columns. The moments are primarily resisted by the 11m back spanning members, requiring intricate continuous connections across the columns.

The brackets range from 2.4m long up to 3.7m and weigh a maximum of 1.3t each.

"The balcony brackets are bespoke, varying in size, shape and arrangement. With the aesthetic considerations conventional hot rolled sections did not work and the only solution was for Hambleton to fabricate brackets from steel plate," says Mr Haines.

Soaring over the grandstand is the structure's most visual element, a 21m-deep cantilevering roof. A series of trusses, spaced at the same 8m centres as the main frame steelwork, supports this aluminum Kalzip clad roof structure.

The 21m-long Warren trusses taper from a maximum depth of 3.6m and are connected to an 11m-long × 4.2m-deep backspan truss section that is incorporated into the roof structure above the hospitality zone.

"The tapered trusses were erected with one 80t capacity mobile crane. We erected them one at a time, but as soon as we had a pair in place they were tied in with all the connecting steelwork before we erected the next truss," sums up Hambleton Steel Contracts Director Andy Fixter.

The works are scheduled to be completed in time for the Festival in March 2016.

**FACT FILE**
**Cheltenham Racecourse Grandstand**
**Main client:** The Jockey Club
**Architect:** Roberts Limbrick Architects
**Main contractor:** Kier Construction
**Structural engineer:** Furness Partnership
**Steelwork contractor:** Hambleton Steel
**Steel tonnage:** 1,660t


*Roof construction progresses*

# In the grove

*Forming the second part of a scheme, 12 Hammersmith Grove is slightly larger than its neighbour, No 10*

**FACT FILE**
12 Hammersmith Grove, London
**Main client:** Development Securities
**Architect:** Flanagan Lawrence
**Main contractor:** Wates Construction
**Structural engineer:** Pell Frischmann
**Steelwork contractor:** William Hare
**Steel tonnage:** 2,000t

## A second steel-framed multi-storey block completes an office-led regeneration scheme in west London. Martin Cooper reports.

The construction of commercial developments in the capital is on the increase, a sure sign that the industry as a whole is on the up.

An array of prestigious office schemes are currently under way in all areas of central London with a host of others in the offing. In Hammersmith, the second and final phase of Development Securities' office-led regeneration scheme is nearing completion.

The scheme consists of two similar office blocks adjacent to the Hammersmith & City Underground station. A Wates Construction-led project team completed 10 Hammersmith Grove in 2013, and the same companies are now working on the slightly larger neighbouring No.12 block.

"Both of the buildings' designs are of the same family, although No.12 has two more storeys and larger floorplates," Pell Frischmann Director Mike Hitchens says. "Having already designed the first structure we've been able to collate project team feedback and thereby tweak the design of No.12 to make it more efficient."

The 10-storey 12 Hammersmith Grove will offer speculative Grade A office space, ground floor and mezzanine level retail space and a generous double-height entrance foyer.

Designed by architect Flanagan Lawrence, the project has been funded by Scottish Widows Investment Property Partnership Trust and is being delivered on the site of a former NCP car park.

Like its neighbour, 12 Hammersmith Grove is a steel-framed composite designed

structure, utilising long-span Fabsec cellular beams throughout for economy and to allow the integration of services within the structural void.

Two centrally placed cores provide the steel frame with its stability, while the majority of the structural grid follows a 7.5m x 10m pattern throughout the building. This grid also incorporates some longer spans of up to 15m on all floors.

To incorporate the 15m long spans, make sure the beams were stiff enough to negate any footfall vibration, and have big enough holes to accept all of the services and thereby keep floor-to-ceiling heights the same, the cellular beams are all 650mm deep sections. They incorporate 450mm diameter service holes and support a metal deck with a 150mm thick slab.

"There are very few internal columns, four in total, and this maximises the desired open plan scheme the client desires," says Wates Construction Project Director Damon Cutler.

The reason for the inclusion of four internal columns on each floorplate is because the structure steps back at eighth and ninth floor levels to provide outdoor terraces.

Without these internal columns large transfer structures would have been necessary and they would have interfered with the desired constant floor-to-ceiling heights.

"Only four internal columns means we still have clear open plan floorplates along with a lighter and more cost-effective steel frame," explains Mr Hitchens.

In order to achieve a contemporary industrial-like office environment, something which has been incorporated into the design at 10 Hammersmith Grove, all of the cellular beams will be left exposed within the completed building.

Many of No.10's tenants are media companies as this part of west London, because of its proximity to the BBC studios in White City, is fast becoming a media hub.

To attract similar tenants to occupy No.12 it is considered important to have this modern design with as much exposed steelwork as possible.

"That's not to say tenants have to stick to this design," adds Mr Cutler. "There is the flexibility that they can always add a false ceiling if they want."

As the beams will be left exposed, extra care has been taken with the design's detailing and connections in order to achieve an aesthetic look, while all secondary beams are spaced at regular 3.5m centres.

"We've used a combination of intumescent and non-intumescent white paint for the beams, because they will be on view in the completed building. Any minor handling damage to the coating system has been remedied on site," says William Hare Project Director Pat Egan.

*The steel frame nears completion*

Steelwork contractor William Hare began its steel erection programme in October 2014 and completed the job in March 2015. It returned to site last summer to install a steel BMU (Building Maintenance Unit) and a plant grillage on the building's roof.

Prior to the company starting on site, Wates had completed the enabling works, which included the installation of piles to a maximum depth of 30m.

All of the steelwork was erected using the site's two tower cranes with two floors erected at a time before the metal decking was installed.

Both of the scheme's buildings will eventually share a common service yard, but during construction all steelwork and other deliveries arrives on site from No.10's service yard entrance.

Once the project is complete, this service yard access route will be paved over and turned into a pubic realm between the two structures. Access to the shared service yard will then be via a new roadway, which is incorporated into the ground floor area of No.12.

This service road is located within the ground floor perimeter columns along two elevations. Consequently the floorplate for the ground floor is smaller as the office areas above span over the road. Columns along these two perimeter lines will be encased in concrete for impact security.

12 Hammersmith Grove is due to be completed in early 2016, and is aiming to achieve a BREEAM 'Excellent' rating.

*The building occupies a plot adjacent to an underground station*

*The structure features clear open plan office spaces*

# Steel ticks all the boxes

**Steel has many benefits that deliver value to designers, contractors, developers and building users. Most arise automatically once the decision to build in steel is made, and at no extra cost.**

## Safety

- ✓ Accurate fabrication work takes place offsite under controlled and regulated factory conditions
- ✓ Fabricated steel is only brought to site when needed avoiding potentially dangerous clutter
- ✓ Fewer people are needed on site, reducing the risk of accidents
- ✓ On site pre-assembly reduces the number of lifting operations and the need to work at height
- ✓ Steel frames are full strength as soon as they are completed so stairs can be fitted, providing safe access for other trades straightaway
- ✓ Steel decking for composite slabs provides a safe platform after installation and protection to lower storeys

## Speed

- ✓ Steel construction is fast with skilled erection teams who have a safety focus
- ✓ Steel gives the earliest start on site and earliest possible pay back on investments
- ✓ Time related savings can amount to between 3% and 5% of the overall project value
- ✓ Fast and safe erection of steelwork makes way for other critical path operations
- ✓ Accurate offsite fabrication eliminates time-wasting quality issues and reworking on site
- ✓ Offsite trial erections of complex structures can ensure that everything goes right on the day

## Quality

- ✓ Quality assurance runs throughout the steel construction supply chain
- ✓ Steel construction provides the surest guarantee of a high-quality finished building
- ✓ Steel sections are tested, certified, and CE Marked before delivery with inspection certificates
- ✓ Fabrication processes are quality assured and fully CE Marked
- ✓ 3D modelling and numerically controlled fabrication systems deliver precision-engineered components to tight tolerances
- ✓ All BCSA steelwork contractors are regularly checked for their technical capabilities and financial standing

## Efficiency

- ✓ Efficient steel designs take advantage of the high strength-to-weight ratio of steel
- ✓ Superior use of space and longer flexible internal column-free spaces can be achieved
- ✓ Lean manufacture within an integrated supply chain gives a more predictable construction programme
- ✓ Just-in-time deliveries can be sequenced and synchronised with the construction programme
- ✓ Steel is fabricated offsite to tight tolerances and brought to site for erection with virtually no waste
- ✓ With 3D modelling as standard practice steelwork contractors have long been delivering the efficiencies of BIM

### Cost

- ✓ Steel is the most cost-effective framing material for buildings and structures of all types
- ✓ Steel is cheaper than it was 15 years ago in inflation adjusted terms, and has fallen in price since 1980
- ✓ Cost saving benefits from productivity advances achieved throughout the steel supply chain are shared with customers
- ✓ A competitive sector with a large number of steelwork contractors ensures that customers get value for money
- ✓ Cost savings in steel buildings start at the foundations, where the loads imposed by a steel frame are up to 50% less than those of a concrete alternative
- ✓ In October, an independent study showed that on a typical city centre office building, the frame and upper floors cost of the cellular steel composite beam and slab option was 12% lower than the concrete alternative

### Sustainability

- ✓ Steel is the world's most recycled material
- ✓ 99% of structural steel used in the UK is either re-used or recycled, waste is minimal to non-existent
- ✓ Steel is multicycled, meaning that it can be used again and again without any loss of quality
- ✓ Steel buildings are adaptable and flexible offering future-proofed solutions
- ✓ Almost all steel-framed buildings can provide optimal thermal mass
- ✓ Signatory companies to the BCSA's Sustainability Charter agree to their sustainability credentials being assessed and monitored

### Acoustics and Vibration

- ✓ Steel-framed buildings easily satisfy the acoustic performance requirements for residential buildings
- ✓ Infill steel-framed external walls provide both acoustic and thermal insulation
- ✓ Conventional steel construction systems meet the required vibration performance criteria without any special measures being adopted
- ✓ Extra stiffening can be applied for extremely vibration sensitive applications like hospital operating theatre floors
- ✓ Even with these additions steel remains the most cost-effective and lightweight solution
- ✓ Long-span applications, for which steel is the only option, have been found to offer excellent vibration damping

### Fire Protection

- ✓ More is understood about the behaviour of steel in fire than any other construction material
- ✓ The UK has a competitive and very effective fire protection industry
- ✓ A continuous programme of research means that cost-effective fire protection measures are always being improved
- ✓ Advanced design and analysis techniques avoid over-specification of fire protection requirements
- ✓ The analysis of composite steel deck floors in fire can eliminate fire protection on many secondary beams
- ✓ Offsite application of thin film intumescent coatings shortens construction programmes

# Steel passes university challenge

## Structural steelwork is playing a pivotal role in the construction of Phase one of Ulster University's new city centre campus.

Phase one of Ulster University's ambitious plans to move from its 1970s suburban Jordanstown campus into Belfast city centre is rapidly taking shape.

By 2018 the university will have completed its £250M project with three new buildings providing 73,000m² of academic space in Belfast's Scotch and Cathedral Quarter – an important emerging cultural district.

Project architect Feilden Clegg Bradley Studios' vision for the scheme envisages the new campus stitching into the historic fabric of the city to combine social, retail and flexible learning spaces around new and enhanced streets and squares.

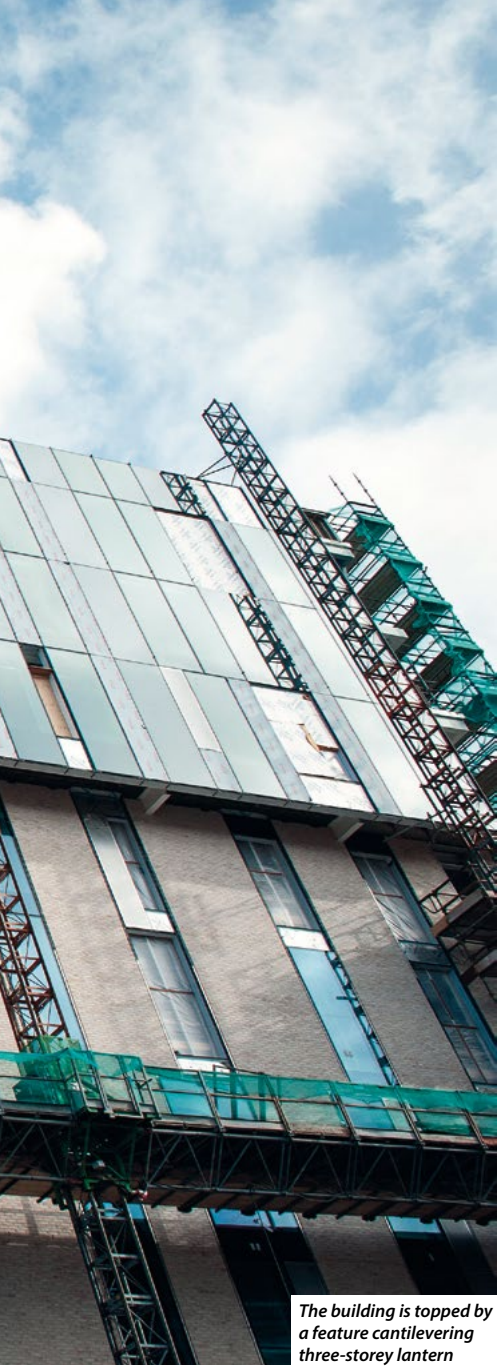
Aiming to achieve a BREEAM 'Excellent' rating the buildings will house six faculties positioned one next to another in order to spark creative debate and innovation between disciplines.

Explaining the reason behind the relocation, Ulster University Acting Vice Chancellor Professor Adair says: "The Jordanstown campus no longer meets our sustainability and carbon footprint targets so we are relocating to exemplar buildings."

"The new campus buildings will act as a catalyst for regeneration, as well as reaching out to the community by being inclusive with public thoroughfares and amenities."

The initial structure to be built is known as Block B and straddles the busy intersection of Great Patrick Street and York Street. It topped out in spring 2015 and opened in autumn. It was built next to the university's existing Belfast School of Architecture, which is currently known as Block 82, although it will be renamed Block A to fit into the overall development programme.

Aiming to achieve a BREEAM 'Excellent' rating, Block B is an eight-storey steel-framed compositely designed building which houses the University's School of Art Design and the Built Environment.



*The building is topped by a feature cantilevering three-storey lantern*

A steel frame best suited the needs for this project as it is a utilitarian building incorporating a number of flexible teaching spaces," explains Mott MacDonald Project Engineer Derek Burnside.

Block B is split into a five-storey base that reflects the heights along York Street and adjacent Block 82, and topped with a cantilevering three-level studio box/lantern.

The protruding upper space is said to reflect the new and emerging architecture that is starting to adorn Belfast's cityscape, while at the same time harking back to the Victorian turrets and towers that many prominent street corners once had.

The cantilevering lantern houses the university's sculpture, painting and design studios. A three-storey void at one end of the lantern accommodates an exhibition area for student's work.

"The large open-plan adaptable spaces creates a unique and exciting environment for our creative industry and built environment student and teaching community, and also provides splendid views over Belfast," says Ulster University Project Director Paul Spray.

*"The large open-plan adaptable spaces will create a unique and exciting environment..."*

Although the cantilevering three-storey lantern was the last element of the steel frame to be erected by steelwork contractor Walter Watson, it involved the most challenging part of the erection programme.

The upper three floors cantilever out by 1.5m at both the front and rear elevations, while the eastern elevation overhangs by 10.5m at one end and by 4.5m at the other end forming a wedge shape.

To form the lantern, storey-high trusses positioned at roof level have been erected - a 10.5m-long and a 4.5m-long truss at each end of the structure with a 7.5m-long truss located half way between the two. The eighth floor is within the trusses' depth, while the two floors below (6th and 7th) are hung from the trusses.

The trusses had to be installed in erectable sections, while the upper floors were temporarily braced. As the three cantilevering floors are hung and supported from the trusses, the temporary steel was only removed when the floors were complete and stability guaranteed.

The aim of providing adaptable and flexible 21st Century teaching spaces throughout the building is evident on all floors of Block B.

Most of the structure's teaching floors can be reconfigured with ease, thereby creating areas suitable for specific needs.

The lower floors of Block B accommodate a two-level library on the ground and first floors, computing suites, a student hub housing more adaptable teaching spaces, printworks, a sculpture department with kilns, as well as woodwork and metal workshops.

Floors two, three and four of the building connect into the existing Block 82. These mid-levels combine workshop, studio and office space for the Faculty of the Built Environment.

*Block B occupies a plot on a prominent intersection*

Although it connects into and is adjacent to an existing building, Block B is a structurally independent steel-framed building. It has been erected around a typical grid pattern of 9.75m × 6m with the steel frame getting its stability from concrete lift and stair cores.

"Beams connect to the cores via shear connectors and as part of our steel package we were responsible for the coring and fixing of these connectors," explains Walter Watson General Manager Structural Division Trevor Irvine.

"Overall this was a very challenging site for us as the building's footprint takes up almost the entire site. We have existing buildings on two sides and busy main roads on the other two sides, so bringing materials to site was difficult and had to be done on a just-in-time basis," sums up Mr Irvine.

**FACT FILE**
**Ulster University Belfast City Campus**
**Main client:** Ulster University
**Architect:** Feilden Clegg Bradley Studios
**Main contractor:** McLaughlin & Harvey
**Structural engineer:** Mott MacDonald
**Steelwork contractor:** Walter Watson
**Steel tonnage:** 750t

## Phase two

Phase two of Ulster University's campus is under way on an adjacent plot and consists of two more new buildings (Blocks C and D).

The two buildings will have eleven and eight storeys respectively and house the Centre for Sustainable Technologies, lecture theatres, exhibition space, eateries and wide circulation routes, many of which will be accessible to the general public.

A steel footbridge, spanning York Street, will be erected to connect Phase two with Block B.


*Steelwork erection was phased around numerous groundworks*

# City centre reborn with steel

**FACT FILE**
Friars Walk, Newport
**Main client:** Queensberry Real Estate
**Architect:** Leslie Jones Architecture
**Main contractor:** Bowmer & Kirkland
**Structural engineer:** Waterman Group
**Steelwork contractor:** Caunton Engineering
**Steel tonnage:** 6,000t

## The large steel-framed Friars Walk development in Newport creates a new retail and leisure destination within a reconfigured city centre.

Newport in South Wales is undergoing a comprehensive programme of regeneration at the heart of which is the 2020 Vision, a masterplan of citywide schemes and projects that aims to deliver a more prosperous and vibrant city.

A central part of the city's regeneration is Friars Walk, a retail and leisure scheme between the River Usk and Newport's existing main retail zone.

Director at Leslie Jones Architecture Brian Tracey says: "The scheme has revitalised Newport's existing retail offer through the creation of modern space and the provision of new leisure facilities. Friars Walk has been purposefully designed to reconnect a disjointed part of the cityscape and create a cohesive, attractive and accessible urban realm."

Friars Walk has delivered 36,000m² of retail and leisure space consisting of three main elements: a three-storey Debenhams anchor store, an eight-screen Cineworld complex and two main blocks of 37 double-height shop units set either side of a pedestrian covered street.

Topping the street is a curved tubular steel frame that supports ETFE lightweight cladding designed to accept the building movement differentials from the main steel frame. The tubular steel beams span the 11m wide street and are seated on large concrete plinths located on the roof of the retail units.



*Friars Walk opened its doors to customers last November*

*"The longest beam we've erected in the auditorium fit-out spans 9m and weighed 1.5t."*

The project also includes an undercroft 350-space car park, 13 restaurants arranged around a new public square and a new bus depot.

Although the Friars Walk scheme had been on the drawing board for some time, construction work only kicked off in early 2014. The site had already been cleared prior to Bowmer & Kirkland taking over, so after some initial groundworks the steel erection programme was able to start in June 2014.

Steel erection began with the Debenhams store followed by the cinema complex, as these two structures have to be handed over first.

"Due to the various fit-out requirements, there are a number of different hand-over dates which we had to include within our steel programme," explains Caunton Engineering Contracts Director Grenville Griffiths. "We also had to phase the erection of the retail area around sewer relocation works." See box.

Steelwork for the three-storey Debenhams store is based around a 10m × 12m grid pattern. The adjoining retail mall, which features double-height shop units arranged in two large blocks either side of an L-shaped pedestrian street, sitting above a car park and large service yard, is predominantly based around a slightly smaller 8m × 7.5m grid. This column setting was chosen as the optimum spacing for both the car park and the retail accommodation above.

The only area in this part of the project that strays from this grid pattern is the basement service yard where a series of 25m span, full building height, Vierendeel trusses have been installed to create the large open area needed for delivery trucks.

The opposite end of the mall from the anchor store features a large public realm to be known as John Frost Square. The lower level that houses the car park under the mall features an array of restaurants around the square. Lifts and stairs link this area with the first floor retail zone and the adjoining cinema.

In order to construct the various sized cinema auditoria, the steel frame changes in this sector with a number of different spans.

"The longest beam we've erected in the auditorium fit-out spans 9m and weighed 1.5t," says Mr Griffiths.

Caunton completed the steelwork last April and Friars Walk opened on 12 November 2015.

Mike Hall

## Steel frame

The entire project is formed by one large steel frame that is divided up into four building block units with designed movement separation joints at the interfaces.

The principal joints are to the Debenhams anchor store with the main retail mall blocks which has a central divide along the main high street, and the junction of the cinema block with John Frost Square.

Stability for the steel frame is gained from a combination of moment frames and bracing located in lift shafts and steel cores.

"Friars Walk needed to be delivered within a tight time frame. With this in mind, we designed the frame using steel as a user-friendly and adaptable product. This provided an agile frame for the exterior cladding, the design of which took inspiration from the surrounding Welsh landscape and Newport's historic architecture," says Director at Leslie Jones Architecture Brian Tracey.

"The exterior incorporates slate to the podium level while the retail and leisure blocks are clad in aluminium cladding and opaque glass, with brickwork to the street level façades."

*An L-shaped covered street divides the central part of the scheme*

## Sewer challenge

"We have two major sewers, each 5m deep, crossing the site. They both had to be replaced with one new sewer during our construction programme," explains Bowmer & Kirkland Project Director Tony Rides.

In order to complete the relocation of the sewers without hindering the project's tight deadline, the steel erection programme has been worked around these subterranean jobs.

The sewers run directly across the main centrally positioned retail mall, consequently Caunton has had to erect these areas in a phased sequence.

At five column locations ground level bridging beams had to be installed to span a sewer. This allowed the columns to remain true to the grid pattern, even though the piles were installed off-grid in order to avoid the sewer alignment.

*Prefabricated units are lifted into place during the construction programme*

**FACT FILE**
Borders Railway footbridges
**Main client:** Network Rail
**Main contractor:** BAM Nuttall
**Structural engineer:** URS
**Steelwork contractor:** Cairnhill Structures
**Steel tonnage:** 255t

# Bridge solutions for new railway

## Steel bridges played an important part in the construction of the UK's first new major railway line in more than 100 years.

Opened in September 2015, the construction of the line between Edinburgh and Tweedbank constitutes the longest new domestic railway to be built in the UK for more than 100 years.

The route was originally opened in 1849 as the Waverley Line and once linked Edinburgh and Carlisle via Midlothian and the Scottish Borders. However as with many branch lines and cross-country routes the line was closed down in 1969.

Pressure from commuter groups finally persuaded the Scottish Parliament to endorse the partial reopening of the line in 2006, with construction work finally kicking off in April 2013.

Although the construction project initially only involves reinstating the 30 miles of line from the Scottish capital to Tweedbank, it has been mooted that if the railway is successful then the remaining 70 mile stretch to Carlisle could also be rebuilt.

According to Transport Scotland, the £294M project will deliver major economic and social development opportunities by providing a fast and efficient rail link. It will significantly increase the accessibility of jobs for the people of Midlothian and the Borders and, as a result of creating an attractive public transport alternative to the car, approximately 60,000 peak car trips per year will be cut from the region's roads.

The Borders Railway has 10 stops, seven of which are newly constructed stations. A total of 95 bridges have been refurbished for the project and 42 new bridges constructed by main contractor BAM Nuttall.

*"We had to install supporting columns and then lift and bolt the various bridge and ramps sections into place."*

Four of these bridges were new steel footbridge structures fabricated, supplied and erected by Cairnhill Structures.

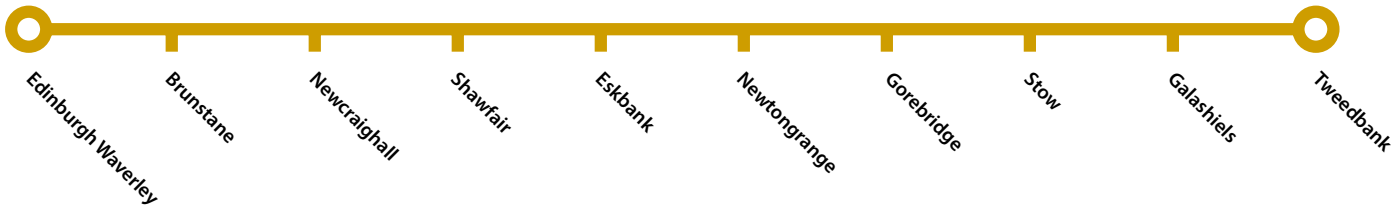
All four footbridges are located in the north section of the railway project – near Dalkeith, which is just south of Edinburgh.

Two of the bridges serve newly constructed railway stations at Shawfair and Eskbank, while the other structures form public crossings across the railway at Station Road and Old Craighall, both near Shawfair.

All of the bridges' spans vary in length with the longest at Old Craighall measuring 24m long and the shortest at Eskbank measuring 10m long.

In order to maximise steelwork's speed of construction and minimise on site work, all of the bridge decks arrived for installation as complete units with their balustrades already in place.

"Staircases also came to site in fully assembled units, while the access ramps were fabricated in two or three sections," explains Cairnhill Structures Director Steven Hendry.




Using a variety of mobile cranes, with the biggest having a 350t-capacity, Cairnhill's installation programme for each bridge was completed in a single day.

"We had to install supporting columns and then lift and bolt the various bridge and ramps sections into place," adds Mr Hendry.

Cairnhill completed its work in early 2015 in readiness for the Borders Railway grand opening in September.

## Shawfair Station

The new Shawfair station supports a large community in the area, including the nearby villages of Danderhall, Newton, Millerhill and Harelaw. The station will also serve 4,000 new homes as part of a £200M development plan recently unveiled by Shawfair LLP.

The new development will see the construction of two primary schools and a secondary school along with an estimated 92,000m² of commercial and retail space available for businesses.

Shawfair station has bus links and easy access to Midlothian's extensive path and cycle network. It has two platforms with sheltered areas for passengers, car parking for up to 59 vehicles and cycle storage for up to 10 bikes.

## Cairnhill hit the road

Celebrating its 35th anniversary, Cairnhill Structures has added National Highways Sector Scheme 20 (the execution of steelwork in transportation infrastructure assets) to its list of accreditations.

The certification is apt as the company has for most of its lifetime been involved with bridge projects, such as strengthening work, refurbishment, repairs and overhauls.

*Speed of construction meant steel was the ideal material for the project's bridges*

*A central span is lifted into position in one piece*

## Other steel bridges on Borders Rail

*Wheatlands Road bridge in Galashiels is constructed (left)*

*One of the many steel bridges erected in south Edinburgh (right)*

# Excellent Monument

**Aiming to achieve a BREEAM 'Excellent' rating, The Monument Building will provide high quality office space in the heart of the City. Martin Cooper reports.**

**FACT FILE**
**The Monument Building, London**
**Main client:** Skanska
**Architect:** Make Architects
**Main contractor:** Skanska
**Structural engineer:** Arup
**Steelwork contractor:** Severfield
**Steel tonnage:** 650t

A new Grade A office development has quickly taken shape adjacent to one of the capital's most famous landmarks – the Monument, which was erected to commemorate the Great Fire of London.

Taking the plot formerly occupied by three buildings that were demolished in 2014, the new structure will offer approximately 8,000m² office space and a further 460m² of ground floor retail accommodation.

All of the upper floors of this nine-storey structure will accommodate offices, some of which - floors four, five, seven and nine – feature outdoor terraces.

Structurally, the building has been designed with a steel frame based around one eccentrically positioned concrete core. Below ground level the structure is founded on concrete raft foundations, while a basement and ground slab have also been formed with concrete.

Most of the building is built around a grid pattern offering spans of up to 12m. The spans vary slightly because although The Monument Building is roughly square-shaped in plan to fill up the entire footprint of the plot, the western side of the structure does offer longer spans.

"So we could minimise the structural floor zone, and hence maximise the number of floors, a steel-framed option was the best solution for this project," says Arup Senior Engineer Michael Heywood. "Cellular beams have been used throughout to accommodate services and in this way we've been able to get a nine-storey structure on a site with strict planning height restrictions adjacent to the historic Monument."

Steelwork contractor Severfield has fabricated, supplied and erected (see box) 650t of structural steel for the project.

Utilising a coordinated multidisciplinary Building Information Modelling (BIM) approach, the project team was able to streamline the design, which in turn helped optimise the steel tonnage to its most efficient amount.

"We always propose that all subcontractors use BIM on our projects as it not only optimises the design but it's also beneficial as it eliminates any clashes and speeds up the programme," says Skanska Project Director Brian Nunn.

Speed of programme is always of importance on any site and, to this end, Skanska decided to install the precast stairs inside of the building's slip-formed core immediately after it was completed.

Having done this work before the steel programme kicked off meant once Severfield did commence work, safe access to the upper floors was already in place, which meant no temporary stairs needed to be installed.

Utilising the project's one tower crane and a combination of access machines, Severfield erected ground floor to level 3 in one sequence and from then on installed two floors at a time.

With the metal decking being installed a couple of levels behind the steel erection, the programme ensured, for safety reasons, that there were always at least two completed floors in between steel going up and the other follow-on trades.

"The steel erection was sub-divided into four phases for each floor, starting in the south east corner and erectors then working around the core in a clockwise direction," says Skanska Senior Site Engineer Andy Flynn.

"Once steel was unloaded from the delivery trucks it was stacked on laydown points, which corresponded with the four phases on top of the completed frame."

Aside from the terraces, formed where the building steps back along its northern elevation, the frame is fairly regimented

in design all the way from ground floor to roof level.

The only exception is a pair of storey-high cantilever trusses along the same northern elevation, which ensure that the building does not load an adjoining party wall by transferring the perimeter column loads inwards.

The party wall belongs to the only building that adjoins The Monument Building's plot and crucially sits atop the Circle and District underground lines, which are just below street level.

"We selected steel for its light structure, which came in handy on the more complex areas of the development where we were close to the underground system. Also known for being an efficient material with sustainable qualities, it was an appropriate choice for the design of The Monument Building," says Make Architects Partner Cara Bamford.

Although this neighbouring building is adjacent to the new structure, both are independent, apart from the fact that the old building's outdoor fire escape has had to be removed during the construction programme and will be re-installed later. It will then incorporate a ground floor escape corridor within The Monument Building's footprint.

"Because of the building's cascading terraces along this elevation, the cantilever trusses support only four storeys as opposed to the nine across the rest of the building," says Mr Heywood. "This means we've been able to achieve an efficient design that works with both the architecture and building services."

The Monument Building is scheduled to be complete by May 2016.

*The new building is adjacent to one of London's most famous landmarks*

## Steel programme benefits from cooperation

The steel erection programme was completed in July 2015, ahead of its planned 20 weeks schedule.

Severfield Project Manager Robin Hamill puts this down to the close coordination his company had with Skanska and the other trades, which ensured the steel erection and metal decking installation was carried out as efficiently as possible.

"We sat down and started planning the project with Skanska 18 months in advance of steel erection starting," he explains.

Most inner city sites pose logistical challenges when it comes to deliveries. The Monument Building is no different as it is slap bang in the middle of the City of London and bounded by two narrow, but busy streets on two sides and a public square along its main façade.

Skanska had been able to get a partial road closure on one of the adjacent streets, which allowed the team to create a delivery and offloading zone, albeit opposite Monument Underground station.

All steel deliveries were coordinated and had to be unloaded from 7am onwards when the road closure was in place. Unfortunately, this timing also coincided with the morning rush hour and the team had to deal with the thousands of commuters that regularly exit the station.

"We had to ensure the steelwork was quickly and safely unloaded from the trucks and then placed on our laydown areas which had to be within the building's footprint – in other words on top of the erected frame," explains Mr Hamill.

*Cellular beams have been used throughout*

*Model showing the steel frame*

# The Next big thing

## A large 25m-high distribution centre for Next is rapidly taking shape on the outskirts of Doncaster.

**FACT FILE**
**Next Distribution Centre, Doncaster**
**Main client:** Next
**Architect:** SiCa
**Main contractor:** Bowmer & Kirkland
**Structural engineer:** Adept Consulting Engineers
**Steelwork contractor:** Billington Structures
**Steel tonnage:** 4,850t

The UK's distribution centre sector is on the up with a raft of projects currently in the offing or under construction.

One of the largest jobs under way in this buoyant marketplace is a new distribution centre and offices for Next. Occupying a footprint of 58,000m², this huge structure is under construction at IDI Gazeley's 115-acre G.Park in Doncaster.

As with the majority of distribution centres, the Next facility is a steel-framed multi-span portal frame measuring up to 380m in length and with spans of up to 37m. One end of the structure features an attached five-storey office block built around precast lift cores.

A steel solution for the construction of this large distribution centre was the preferred option for a number of reasons, most notably the speed of construction, the long span qualities needed and cost efficiency.

"The client wanted this bespoke building to look modern, clean and attractive. It needed to meet the demands of the current business with a view to future flexibility and expansion," explains SiCa Partner Simon Noblet.

"The building design has evolved from, and is subservient to, the sophisticated materials handling equipment within. It is also hoped that this new warehouse will be a pleasant place to work in with first-class facilities for both warehouse and office staff."

The steel frame's columns are set at 8m intervals, which correspond with the internal racking system's geometry. Likewise the portal spans have also been designed with the building's internal functions in mind.

Four of the portal frame spans are 29.3m, but along one elevation there is a 37m span, which has been designed to accommodate a large multi-storey mezzanine structure.

This wider 37m span will also accommodate the facility's bespoke docking system where trucks' trailers are disconnected outside the building and then automatically transported inside for loading.

Between the 37m span and the first of the four 29.3m portals there is one narrower 18m wide portal. This portal was made smaller because of the project's footprint constraints.

Concept design for the project was by Adept Consulting Engineers, however detailed design of the complex steelwork was carried out by Billington Structures.

"We've also designed flexibility into the steel frame," explains Adept Consulting Engineers Project Manager Erol Erturan. "The mezzanines have been erected as a two-storey structure, but a third level, if required, can be accommodated in the future as the distribution centre has a 21m height to the underside of the haunch."

Stability bracing will also render the internal mezzanine floors independent of the main building, enabling them to accommodate a complex system of tracks for an automated handling system.

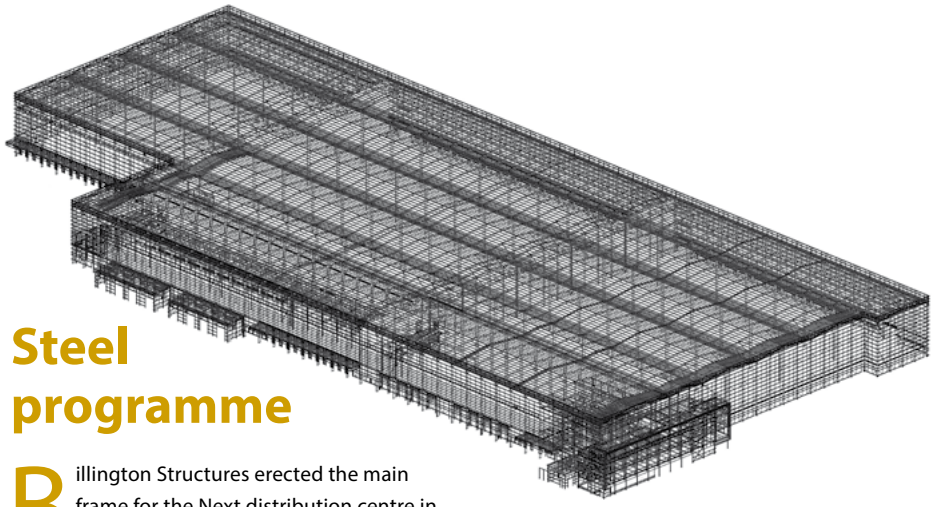
The structural design includes the overall building being split into five separate independently stable zones by party walls, which will ensure that the warehouse remains operational in the event of a fire in one of the compartments.

The compartments are not all the same size and the two largest are five spans wide and accommodate the Centre's high bay racking system, which will be serviced by robotic cranes.

The project also includes a conveyor link bridge from the north eastern corner of the building to transfer stock to the existing Next warehouse, across Holme Wood Lane.

The bridge will be a four span 120m-long structure formed with a series of trusses to accommodate the double deck configuration. The lower deck will feature conveyor belts for transporting goods,

Coordination between steel deliveries and the erection has been key



## Steel programme

Billington Structures erected the main frame for the Next distribution centre in 14 weeks. In order to not clash with the site's other trades, the company then erected the mezzanine floors on a return visit later in the programme.

Prior to the steel erection starting, Billington had already begun its on site preparation work and had started stockpiling steelwork.

"The columns are 25m long and up to 9t each, so we could only transport them on a truck to site two at a time," explains Billington Structures Contracts Director Brian Turton.

"That's why it's important to have steel deliveries carefully co-ordinated and steel stockpiled on site in the respective working areas… to ensure that we could give continuity for the erection teams on site."

The portal rafters were brought to site in two sections and then erected in pairs. Using two mobile cranes, the rafters were lifted into place, bolted to their respective columns and then bolted together at midpoint before being released from the cranes.

*"The client wanted this bespoke building to look modern, clean and attractive. It needed to meet the demands of the current business with a view to future flexibility and expansion."*

while the upper deck will be a pedestrian thoroughfare for the workers.

The 40-acre site will accommodate 394 car parking spaces, including 21 disabled spaces, which are to be located on the western part of the site. Twenty five covered parking spaces will also be provided, while 48 HGV parking spaces are to be provided to the northern side of the building within the dispatch yard, together with 15 trailer box parking spaces and 55 loading bays.

Billington CEO Mark Smith, said: "The construction of a distribution warehouse on such a large scale involves a great deal of complex planning.

"The fact that Bowmer & Kirkland has once again chosen Billington Structures to provide the structural steelwork for one of their most significant and prestigious projects, and indeed clients in Next, is testament to Billington's quality, reliability and performance."

Summing up the project Bowmer & Kirkland Project Manager Ben Howard says: "Erection of a 25m high distribution facility, with ancillary offices and building services, doesn't come without its own challenges.

"Early access dates and a tight overall schedule dictate a correctly sequenced approach by ourselves, which guarantees a defined outcome for our client.

"Utilising specialist contractors in their own fields early on is essential for the co-ordination of design, erection sequencing and programming alongside interfacing elements. This gives us the best opportunity for a achieving our project goals."

The Next distribution centre is due to be complete by April 2016.

The huge distribution centre takes shape

Columns are up to 25m high


# The steel encyclopaedia

## The steel sector's website – www.steelconstruction.info - has become the number one destination for architects and engineers to access steel related information.

Launched in October 2012, www.steelconstruction.info brought together for the first time all the sector's technical and cost information, which was only previously available from a variety of different sources.

Described as the free encyclopaedia for the UK steel construction sector, it was designed to be easy to use, as comprehensive as possible, and the one-stop-shop for technical guidance on steel construction.

Chris Dolling, Manager, Technical Development at BCSA explains: "We were responding to the needs of designers with this new website. We set out to provide the best possible internet-based source for steel construction information and with almost identical functionality to Wikipedia. We feel this is exactly what we've achieved as all of the feedback has been very positive."

During the three years since it was launched, the website has developed enormously with significant improvements in functionality, the addition of lots more content and regular updates to ensure the information provided remains current.

Here are some of the highlights:

### Improvements:

- The 'Main page' has been redesigned with the addition of colour, images and new sections on 'Featured Projects' and 'Featured Articles'
- A new Google search facility has been installed to improve the number of search results found, the relevance and the prioritisation
- All of the videos on the website have been reconfigured to play via a YouTube channel, so they will run on a wider range of browsers/devices
- A 'Sitemap' and 'Index of main articles' has been added to aid both navigation, and give users an appreciation of the broad range of content on the website
- All of the sector case studies have been converted from a PDF format to fully integrated / hyperlinked page content to aid browsing
- A new magazine style PDF reader has been installed to enhance the viewing of all the features on the Steel Construction News page

- An embedded webinar facility has been added, and used to deliver training on a range of subjects including Fire engineering, Embodied Carbon and Thermal mass. These webinars are automatically recorded to YouTube and made available afterwards as online CPD with the usual testing and certification functionality.

**New content:**

- 'Steel construction news' contains all of the recent press features and steel supplements from a range of construction industry magazines
- 'Design software and tools' brings together an increasing number of free software packages and spreadsheet tools from the steel construction industry intended to aid designers
- Articles on cost planning for Industrial buildings, Education buildings and Healthcare buildings offer guidance on current cost ranges and the key cost drivers for steel-framed buildings in those sectors
- 'Video case studies', has interviews with the participants interspersed with footage of the structure and are used to describe recent projects, and the challenges faced during construction
- 'Steel section sizes', is a key resource providing users with swift access to steel section sizes and property data for hot-rolled sections from Tata Steel
- 'CE Marking' highlights how the steel construction sector has been working behind the scenes; what it will mean for the sector and what needs to be done to comply with the Construction Products Regulation
- 'Resources for students' contains articles on the design and construction of steel-framed buildings aimed specifically at engineering and architectural students
- New videos on Eurocodes, CE Marking, Sustainability and how to use the Blue and Green Books have been uploaded
- 'End of life LCA and embodied carbon data for common framing materials' contains a complete cradle-to-cradle dataset for embodied carbon.

**Updates:**

The cost table, cost comparison figures, and BIS location factors are updated throughout the cost articles every quarter to suit the latest data from Gardiner & Theobald, and a formal maintenance regime ensures that every article is reviewed on a rolling two-year cycle.

The SSDA article is updated every year to feature the initial short-listed projects and then the winners as soon as they are announced. Fully hyperlinked 'Case studies' for each winning project are created and added to the ever-growing bank of project data.

For those who are new to www.steelconstruction.info the site has well over 100 wikipedia style articles, written by the steel sector's own experts as well as external consultants, and covering best practice in the use of steel across the construction sector, as well as topics such as fire engineering, costs, sustainability and health & safety.

These core articles act as a roadmap to each topic using links to more detailed information available from the sector and other external sources. A number of online CPD presentations are also included, which enable the user to take a test and download a certificate for their records.

There is also a host of links where users can go directly to web-based steel design software and tools, while the news section allows access to a number BCSA and Tata Steel supplements that have appeared in the construction and architectural press, such as Construction News and Building magazine.

The steel sector has an on-going pipeline of research and development work, and continuously updates its guidance in line with changes in legislation, standards and industry practice. Consequently, the website is also updated on a regular basis, and registered users (one can register on the site) get quarterly email alerts highlighting all of the site's new features, updates and additional information.

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# Frame costs assessment made simple

## New guidance from the steel construction sector used with regularly updated cost data makes potentially tricky exercises in cost planning straightforward.


Steel is by a large margin the most popular framing material for most building types in the UK – around 70% of multi-storey buildings and over 90% of single storey industrial buildings are steel framed.

Along with a wide range of benefits affecting sustainability, flexibility in use and future proofing, steel delivers significant cost advantages compared to alternative materials. For a start, the lower self weight of steel ensures a lighter structure that demands smaller and cheaper foundations.

There are a multitude of programme and other advantages to be gained from using off site fabricated steel, many impacting directly on the bottom line, which the steel construction sector is dedicated to ensuring that designers, contractors and their clients fully appreciate how to take advantage of.

Properly costing the alternative framing solutions at the early planning stages can be a tricky exercise but the steel sector produces regularly updated guidance on the cost planning process itself as well as updates on real world prices for structural steelwork.

The cost planning process guidance, from Tata Steel and the BCSA, can be downloaded free from the website

**BCIS rates for different locations as of 17/09/2015 (UK Mean = 100)**

| Location | BCIS Index |
|---|---|
| City of London | 113 |
| Nottingham | 105 |
| Glasgow | 103 |
| Newcastle | 100 |
| Manchester | 96 |
| Birmingham | 94 |
| Liverpool | 92 |
| Leeds | 91 |
| Cardiff | 90 |
| Belfast | 59 |

## Realistic cost information

Realistic cost information has to be provided very early in the construction planning process to support decisions on what structural frame materials to use.

These decisions are very difficult to change later as this could lead to delay in the construction programme, partly due to impacting the design of other building elements like foundations, finishes and cladding. A wrong decision can lead to higher costs than necessary for the frame and other elements.

The guide leads planners through the process of choosing the frame material and configuration of a project, key early decisions that are usually based on initial outline information and comparative budget costings.

Cost models and benchmarks are key tools at these early stages and cost consultants need to develop a thorough understanding of both the project and the historic cost data used so they can adapt standard cost ranges to suit a specific project.

A range of key cost drivers will have to be considered including building function, sector, location and site constraints, as well as current market conditions and the proposed procurement route.

The guide explains that when undertaking cost analyses of alternative structural options or systems, it is important not to review frame costs in isolation, but to also consider the impact that frame choice has on related building elements, such as substructure, cladding and M&E installations, to allow proper comparative costings.

Once a design has been developed, the initial budget will be tested against the emerging design of the actual building through a quantification of the key components.

At this stage, the key cost drivers considered during early estimates, such as function and site constraints, will be reflected in the designs used for cost planning. Other factors such as section sizes and availability, connections, fire protection requirements and construction methodology also have to be considered to ensure that an appropriate rate per tonne of steel is selected.

Consideration of these key factors throughout the design stages along with early consultation with the supply chain can help make sure that realistic costing of the steel frame and associated elements is maintained and improved as the design develops.

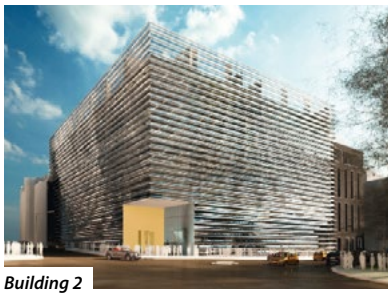
The guide provides a study of two typical buildings – a business park office building and a city centre office building – to provide a comparison for reference when considering the structural frame options.

These studies are made by independent teams from G&T, Peter Brett Associates and Mace Group – to reflect changes in construction techniques and structural frame solutions since earlier studies.

| Building 1 rates at Q3 2015 on GIFA basis (City of London BCIS Location) | | | | |
|---|---|---|---|---|
| | Steel composite | Steel + Precast Concrete Slabs | Reinforced Concrete Flat Slab | Post-tensioned Concrete Flat Slab |
| Substructure | £62/m² | £65/m² | £80/m² | £74/m² |
| Frame and Upper Floors | £161/m² | £177/m² | £163/m² | £176/m² |
| Total Building | £1757/m² | £1800/m² | £1875/m² | £1852/m² |

*Building 1*

| Building 2 rates at Q3 2015 on GIFA basis (City of London BCIS Location) | | |
|---|---|---|
| | Steel Cellular Composite | Post-tensioned Concrete Band Beam and Flat Slab |
| Substructure | £65/m² | £70/m² |
| Frame and Upper Floors | £221/m² | £247/m² |
| Total Building | £2208/m² | £2301/m² |



*Building 2*

www.steelconstruction.info. It is based on regular research by cost consultants Gardiner & Theobald (G&T) into key aspects of structural steelwork design and construction for the Steel Insight cost studies series which is also available free at www.steelconstruction.info

Following the procedures in the guide provides clarity for cost planners through the various stages involved in pricing structural steelwork. All the key factors that need to be taken into account are highlighted, from initial design stages through option analysis and on to detailed design. The aim throughout is to show how a sometimes complex calculation can actually be made straightforward.

Assembling the relevant information at each stage in the process is fundamental to achieving optimal solutions, and the guide shows how to do this properly, ensuring that the correct information is sourced.

The guide is designed to be used in conjunction with the information detailed in the Steel Insight series which helps cost planners get over the problems that can arise in trying to get accurate cost information in fast changing markets, providing regular quarterly updates on steel construction costs from G&T.

Each of the detailed articles in the Steel Insight series includes an update of standard cost tables to help cost planners. Other free assistance provided recently by the steel sector to help cost planners and designers in assessing their options include guides on Embodied Carbon, Thermal Mass and Fire Protection.

All of these and other up-to-date information on issues like using Building Information Modelling, and on the acoustic and vibration performance of steel, can also be found at www.steelconstruction.info

## Location and site constraints

A range of factors affect initial cost estimates, including the building's function and facilities, location and site constraints, market conditions and procurement route, and the guide explains their potential impact on proper assessment of costs for structural steel frames.

For example, for analysing the impact of location and site constraints on cost estimates the use of the most commonly used guide to cost indices for different locations – the Building Cost Information Service (BCIS) from the Royal Institution of Chartered Surveyors – is explained.

The importance of adjusting the rate for the proposed location to make sure that the different local market conditions are taken into account is highlighted – using a City of London benchmarked rate (BCIS index 113) for a new project in Cardiff (BCIS index 90) would significantly affect the accuracy of the estimate.

The site itself also has a direct impact on the proposed building's design and cost. For instance, it may affect the floor plate configuration, building height and the regularity of the structural grid.

A regular, repeating grid is the most cost efficient option, and if non-standard sections or a wide range of different sections and connections are needed, the project will be more complex and therefore more expensive as fabrication costs will be higher.

Some buildings have specialised requirements, such as retaining a historic façade, close neighbours or poor ground conditions to overcome. If these require complex structural solutions such as transfer structures and heavy fabricated beams, the bespoke fabrication costs will push up the overall cost and may also add to installation time and cost.

| Benchmark rates at Q3 2015 on GIFA basis | | |
|---|---|---|
| Type | BCIS Index 100 | City of London |
| **Frame** | | |
| Low rise, short spans, repetitive grid/sections, easy-access (Building 1) | £105-130/m² | £115-140/m² |
| High rise, long spans, easy-access, repetitive grid (Building 2) | £145-175/m² | £165-195/m² |
| High rise, long spans, complex access, irregular grid, complex elements | £180-205/m² | £205-230/m² |
| **Floor** | | |
| Metal decking and lightweight concrete topping | £50-69/m² | £55-77/m² |
| Precast concrete floor and topping | £55-74/m² | £62-82/m² |
| Fire protection (60 min resistance) | £17-26/m² | £18-28/m² |
| **Portal frames** | | |
| Low eaves (6-8m) | £59-80/m² | £65-87/m² |
| High eaves (10-13m) | £73-97/m² | £82-107/m² |

# Eurocode revision

**British Standards Institution (BSI) has published a revised Eurocode 3: Design of steel structures, as well as a revised National Annex.**

BS EN 1090-2 *Execution of steel structures and aluminium structures: Technical requirements for steel structures* introduced the concept of execution class as an aid to designers when specifying the execution requirements for steel structures.

British Constructional Steelwork Association (BCSA) Director of Engineering Dr David Moore said: 'It was recognised by the European committee responsible for BS EN 1090-2 that it would be more appropriate for such guidance to be given in the design standard for steel structures, BS EN 1993-1-1 and hence a revision to this standard was developed."

Guidance on the selection of Execution Class has now been included in a new normative Annex C to BS EN 1993-1-1. Annex C links Execution class to the Consequences Class/Reliability Class of the structure and the type of loading (static, quasi-static, fatigue and seismic actions).

It also includes restrictions on the use of Execution Class 1. Guidance on both of these recommendations is subject to National Determination and the UK has published an amendment to the National Annex to BS EN 1993-1-1 which replaces the guidance given in Table C.1 – Choice of execution class (EXC) and the restrictions on execution class 1 given in clause C.2.2(4) of Annex C of BS EN 1993-1-1.

The National Annex replaces Table C.1 of BS EN 1993-1-1:2005+A1:2014 with an alternative table that links Execution Class to Consequences Class/Reliability Class, the sensitivity of the structure to fatigue , the grade of steel and seismic actions.

This table is limited to structures designed according to the BS EN 1993 and other appropriate Eurocodes. The National Annex does not give any limitation on the use of Execution Class 1 but states that its use is not endorsed for general use.

Dr. Moore said that while each structure needs to be considered on its own merits Execution Class 2 will

be appropriate for the majority of buildings.

BS EN 1993-1-1:2005+A1:2014 replaces BS EN 1993-1-1:2005 which has been withdrawn. Similarly the National Annex to BS EN 1993-1-1:2005+A1:2014 replaces the National Annex to BS EN 1993-1-1:2005 which has also been withdrawn.

Although BS EN 1090-2 remains current the guidance on the selection of Execution Class is given in an informative annex [i.e. supplements normative material by offering advice, information and guidance].

The requirements given in the revised BS EN 1993-1-1 is given in a normative annex [i.e. is essential to the application of the standard]. The BCSA therefore recommends that for new projects the selection of Execution Class should be based on the recommendations given in normative Annex C of BS EN 1993-1-1:2005+A1:2014 and its supporting National Annex.

Copies of both BS EN 1993-1-1:2005+A1:2014 and its National Annex are available from BSI publications at: www.bsigroup.com/shop or alternatively BCSA members can purchase them, with a 10% discount. from the BCSA by contacting: don.thornicroft@steelconstruction.org


## Updated Steel Construction CE Marking brochure

CE Marking of fabricated structural steelwork has been mandatory since 1 July 2014. It is also a legal requirement for all fabricated structural steelwork delivered to site to be CE Marked.

To comply with the regulations, only steelwork contractors with an Execution Class equal to that required for a project should be considered.

Contracts for fabricated structural steelwork for buildings should include the NSSS for Building Construction 5th Edition CE Marking Version. This specification incorporates the obligations of the CPR and CE Marking on the steelwork contractor.

To help BCSA members understand their obligations, the Steel Construction CE Marking brochure has been revised and updated to fully incorporate all of the recent changes.

The brochure is available free at www.steelconstruction.info/Steel_construction_news

# The engineer's responsibility for CE Marking

**Consequences Class**

**Table 11 Approved Document A**

**Execution Class**

**Table NA.4 National Annex to BS EN 1993-1-1: 2005+A1:2014**

The engineer is responsible for specifying the Execution Class for the structure as a whole, the components and the details that they have designed.

Procedure for specification of Execution Class for a building:

1. Determine Consequences Class – Table 11 of Approved Document A *[Usually 2a or 2b]*
2. Select Execution Class – Table NA.4 of the National Annex to BS EN 1993-1-1:2005+A1:2014 *[Will typically result in EXC2]*

Whilst each building needs to be considered on its own merits, EXC2 will be appropriate for the majority of buildings constructed in the UK.

If the Consequences Class is not specified clause NA.2.27.2 of the National Annex to BS EN 1993-1-1:2005 +A1:2014 states that it should be assumed that the design rules in BS EN 1993 are safe for Consequences Classes up to and including CC2.

# Taking the gamble out of your tender selection


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

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

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

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

Ensuring steelwork contractors are competent, capable and qualified

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

**The British Constructional Steelwork Association Ltd and**
**The Register of Qualified Steelwork Contractors Scheme for Bridgeworks**

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