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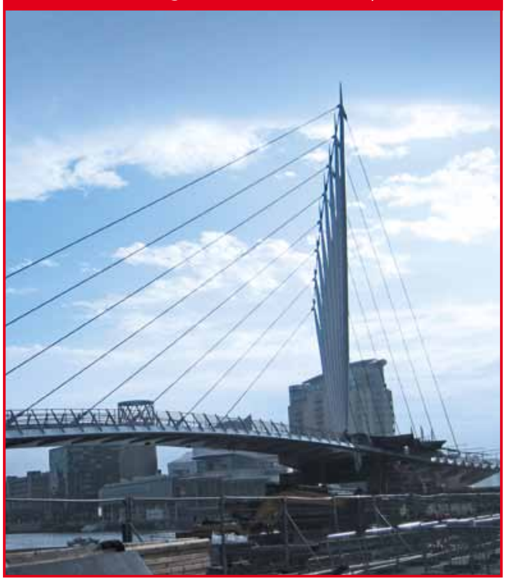
NSC

April 2011 Vol 19 No. 4

New Merseyside campus

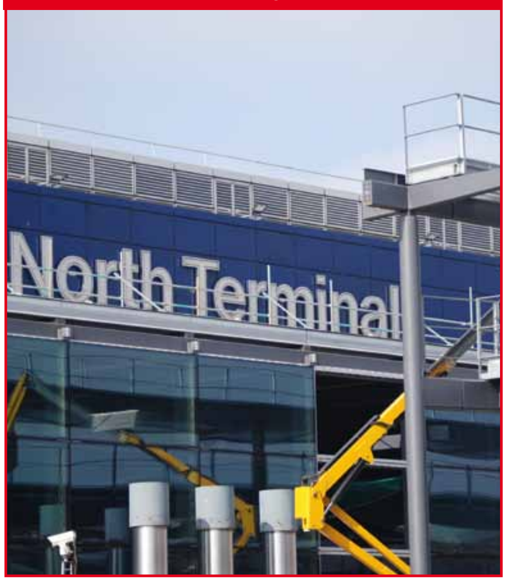
Steel does it for B&Q in Swindon

Bridge link to Media City



Tesco goes direct to steel

Gatwick's top flight terminal



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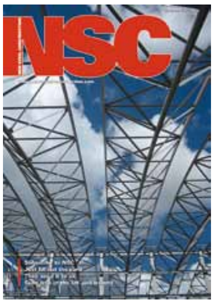

New Steel Construction keeps designers and contractors abreast of all major steel construction related developments and provides detailed technical information on key issues such as the introduction of the Eurocodes. NSC will be the first place most people hear about advances made by the extensive research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

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

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

A recent development has been the introduction of Steel Industry Guidance Notes, SIGNS, with each issue of NSC, a loose leaf insert series aimed at students and designers new to steel construction. SIGNS provide essential introductory explanations of basic steel related design topics and point the way towards where more detailed, free, support can be accessed in the steel sector.

NSC is available free of charge each month to subscribers living in the UK or Ireland by simply filling in the reply paid card bound into this issue, or by contacting us by email, post or fax as described on the card.

If the card has already been removed from this issue you can fill out this form and fax it to **020 7747 8199**, or scan and email it to **admin@new-steel-construction.com**

Name

Position

Company

Address

Postcode

Telephone

Email

Cover Image
B & Q Distribution Centre, Swindon
Main Client: Gazeley
Architect: Chetwood
Steelwork contractor: Caunton Engineering
Steel tonnage: 2,400t

BCSA TATA STEEL SCI Steel Knowledge

NSC

April 2011 Vol 19 No 4

These and other steelwork articles can be downloaded from the New Steel Construction Website at *www.new-steel-construction.com*

Steel for sustainable cost cuts

Nick Barrett - Editor

Now that the Budget is behind us construction is looking ahead to what looks like a fairly subdued recovery from what has been a painful recession, but at least it is a recovery. We already knew about the government's deficit reduction related spending plans and the Budget has spelled out what the revenue raising plans are, so the pieces that will shape our short and medium term economic future are all falling into place.

The private sector has been handed the challenge of leading us forward from recession and the Chancellor threw down another gauntlet to the construction industry in particular when at the same time as the Budget he announced plans to cut public sector construction costs by 20%. This will be achieved by a series of procurement reform initiatives yet to be announced, and by looking for more standardisation in public sector buildings. This might mean a reduction in design input, which could throw up problems of its own, but we shall see.

What is clear is that a cost cutting drive is on across the public sector and the client, who can't afford to take no for answer, is asking challenging questions of the construction industry. Many of the correct answers will include a steel construction solution, and the steel sector can only welcome a client taking a harder look at costs.

Offsite manufactured steel building should immediately spring to mind if more standardisation is sought. Steel's flexibility would also come into its own if future ideas for what a school, for example, should like change. An excellent example of the benefits of this flexibility can be seen in London where the future of the London Olympic Stadium has been decided, with West Ham Football Club to be based in a reconfigured stadium. It would not have been possible to consider such a variety of options if the stadium had been made with any other material.

There is no sign yet that the drive for cost cuts has weakened the resolve for more sustainable buildings, and further proof that there are cost effective routes to carbon reduction using steel framed buildings is delivered with the Target Zero supplement that comes with this issue of NSC.

Results from three of the five Target Zero studies provide designers, architects and engineers with guidance to meet the government's 2019 zero carbon emissions reduction target. The first three are now available for download at *www.targetzero.info*, covering schools, warehouses and supermarkets. The final two reports for offices and mixed-use developments will be available shortly.

In house training can be provided by steel construction experts for anyone who wants it by calling the Target Zero Information Line on 01709 825544, or by emailing *info@targetzero.info*. Standardising on sustainable buildings is something that we would all like to see; and the best way to ensure it will be to design in sustainable steel.

NSC

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Velodrome crosses the finishing line

Construction work on the London 2012 Olympic Park Velodrome has been completed and the Olympic Delivery Authority (ODA) has proudly unveiled it as the first venue to be finished, on time and to budget.

A number of test events are now planned over the next 12 months, and these will ensure the venue is ready for its big showcase in 2012.

The 6,000 seat Velodrome will host the Olympic and Paralympic track cycling events next year. After the Games, the legacy Velodrome will be used by elite athletes and the local community and will include a cafe, bike hire and cycle workshop facilities.

Like many of the main venues, steel has played a prominent role on this project and more than 1,100t of structural steelwork was erected by Watson Steel Structures, which equated to 2,500 individual sections. A tubular steel ring beam sits on top of steel trusses and goes around the entire perimeter of the structure, in a rollercoaster fashion, forming the Velodrome's distinctive shape.

The Velodrome was constructed over a period of 23 months with up to 450 workers on site at the peak and 2,500 workers involved through the course of the project. Some 48,000m^3 of material was excavated to create the bowl for the venue, enough to fill 19 Olympic sized swimming pools.

Sustainability has played a major role in the design and construction of the Velodrome. Richard Arnold, Project Sponsor for the ODA, said: "This venue is 50% lighter than Beijing's. By using the materials we've chosen we have produced a lightweight, efficient and sustainable landmark for the northern end of the Olympic Park."

The Mayor of London, Boris Johnson, commented: "This magnificent structure is a triumph for all those involved in its design and construction."

Olympic Park transformation gathers pace

As the countdown begins, these latest images bear witness to the fact that the construction programme at the Olympic Park is within touching distance of the finishing line as all of the major structures are nearing completion.

ODA Chairman John Armitt said: "The 'big build' of the main Olympic Park venues is on track to be complete this summer as planned, ready for test events ahead of the Games. These new images show the transformation of a former industrial area into a great new park with world class sports venues and a new network of roads, bridges and infrastructure."

Recent on site progress on steel construction projects has included the structural completion of the main Olympic Stadium, as the roof and all spectator seats have now been installed. Later this year the turf for the field of play and running track will both be laid.

The permanent structure and wave-shaped roof of the Aquatics Centre is also complete and work is now under way to construct the temporary seating stands which will be demounted after the Games.

Both the Broadcast and Media centres are now complete, while work is now underway to finish the Handball Arena and the Water Polo venue, two more projects relying on structural steelwork.

Manchester peddles new BMX centre

The UK's first national indoor BMX centre is under construction at Eastlands in Manchester and is planned to be completed by this summer. Steelwork - being erected by SH Structures - is playing an integral role in the project as a series of long span roof trusses have been erected to form the large hall. This new facility will be linked to the existing Manchester Velodrome, and together they will form the National Cycling Centre, the home of the British Cycling Federation. The 10,219m^2 BMX Centre will include a 2,000 seat arena plus shopping and cafe facilities. More than 125,000 visits to the Centre are expected each year and thousands of dedicated hours have already been set aside for the local community. Main contractor for the project is Sir Robert McAlpine.

Supplement maps out routes to zero carbon buildings

A supplement entitled *Cost effective routes to carbon reduction* is available with this issue of NSC.

Commissioned by the BCSA and Tata Steel, the free supplement explains what the Target Zero study is and encourages readers to fully engage with and visit the website *www.targetzero.info*, to obtain more in-depth information.

The chapters within the supplement only touch on some of the findings from Target Zero research which has so far resulted in three guidance reports - schools, warehouses and supermarkets - that can be downloaded free of charge from the website.

Two more reports, offices and mixed use, will be available very shortly and readers can pre-register to receive them.

Launched last year, Target Zero provides guidance on the design and construction of sustainable, low and zero carbon buildings in the UK. This free resource provides designers, architects and engineers with the guidance they need to meet the zero carbon emissions target set by government for 2019.

Iconic bridge to unite city

The Peace Bridge, a self-anchored suspension bridge, spanning the River Foyle and uniting historically separate communities in the city of Derry~Londonderry, is nearing completion.

The S-shaped pedestrian and cycle bridge is 312m long and as well as spanning the river it also crosses a railway before linking up to an elevated abutment at the east bank.

A total of 1,000t of structural steelwork was required for the construction of the bridge. Steelwork contractor Rowecord Engineering, working on behalf of main contractor Graham Construction, split the bridge into twelve sections along its length for ease of fabrication.

The bridge decks, which vary in width, were partially assembled at the Port of Londonderry before being delivered to site. Because of its length, most of the steelwork was erected by a floating crane with steelwork delivered to the project by barge.

The client for the project is Ilex Urban Regeneration Company with EU Peace III funding provided under the Shared Space programme.

Steel structures supplier claims innovation award

FLI Structures, part of the Haley Group, has been presented with a Birse Rail Supply Chain Award for Innovation in recognition for its pioneering Hand Install Foundation System.

This FLI system was used by Birse for the construction of refuge platforms on the West Coast Main Line. It comprises of screw piles installed with a hand held motor and interface grillages that are light enough to be carried.

The system is quick and easy to install, and allowed Birse to carry out work which would normally have required time-consuming and costly track possessions. It can be used to support lighting columns, refuges, LOC and other platforms, CCTV masts, and can also be used for embankment stabilisation or for soil nailing projects.

FLI says its screw pile foundations and grillages are an "all steel" sustainable foundation solution - a prerequisite to meet today's demanding environmental standards.

L to R. Martin White Managing Director Birse Rail presents Tony Parker, FLI Sales Manager with the Supply Chain Award.

AROUND THE PRESS

Construction News
17 March 2011
Shoppers and shovels kept separate at mall
(Bluewater Events Venue) In the halls, the steel frame has been reinforced so that it is possible to suspend weights of up 3.5 tonnes from it (the idea being that it can be a useful feature for car shows).

New Civil Engineer
17 March 2011
Pit stop precision
(Silverstone pit and paddock) "One of the main reasons for choosing a steel frame was that it gives us this flexibility," adds John Rhodes of Populous. "Using a fairly large open plan grid, the hospitality areas can either be partitioned into separate boxes or the whole floor can be open plan for exhibitions."

Building Magazine
18 March 2011
Up close and personal
West Ham is exploring the installation of retractable seating (Olympic Stadium) systems ... although it will not be adopting the Eastlands model, where the pitch level was lowered in order to accommodate a new tier of pitch side seating.

New Civil Engineer
10 March 2011
Twisted tale
The Orbit (Olympic Park) is an extremely complicated shape. Around 9km of steel tubes - not one identical to another - connect to form an intricate geometric shape via connecting star nodes.

The Structural Engineer
15 February 2011
Green credentials of new temperature controlled high bay warehouse
(The green warehouse is) a braced steel frame structure with tapered lattice steel trusses 3.2m deep at 7.2m centres spanning clear over the 45m width of the building, and a precambered glazed triangular truss supported on a truss tower to the north end of the building.

Stockholder opts for fully automated processing line

One of the UK's leading steel suppliers, ParkerSteel, has installed a fully-automated structural saw/drill line at its site in Canterbury.

The new Kaltenbach installation comprises, a KBS 1051 mitre cutting band saw, which is claimed to be one of the world's fastest structural saws, inter-linked with an AS 1051 auto sorter. The saw is also close coupled to a heavy-duty, drilling system, a KDXS1015, which is a three axis, five tools per axis, carbide drilling machine.

Kaltenbach claim to have perfected the ultra fast carbide drilling and processing of steel columns and beams, with carbide drills cutting 500% faster than HSS bits.

Other features of the Kaltenback, ParkerSteel installation include: contour marking, automated hard-stamping and automatic input/output material crossway and conveyor handling systems, together with logical processing and control software.

The KBS 1051 is CNC controlled, and is said to fully exploit the full potential of carbide bands, with up to 100% faster cutting speeds said to be achievable. A key element of the Kaltenbach band saw's performance is its use of a ball screw spindle and servomotor drive for the saw band feed. This system is said to help ensure continuous, highly accurate and repeatable smooth operation and feed rates under very high performance cutting conditions.

"More than ever in today's market, operating efficiency is key to being competitive on cost and service levels," said Guy Parker, ParkerSteel Managing Director. "Our new Kaltenbach steel processing and logistics capability, along with other technology investment at our Canterbury site, helps ensure we meet our key objectives of cost effective, ultra-low operating costs and high customer service."

Community hub will speed up regeneration

Billington Structures said its record for involvement in high profile projects has been strengthened with its appointment by Willmott Dixon to work on a flagship community hub in Nottingham.

The company has moved on site to build the community hub in St Ann's, Nottingham , which is part of a major programme to regenerate the neighbourhood and create new community facilities.

The Joint Service Centre has been devised by NHS Nottingham City , Nottingham City Council and Nottingham City Homes to bring together a range of existing and new services under one roof.

More than 300t of steel for the project is being supplied and erected by Billington for the state-of-the-art building. When complete by February 2012, it will include: modern health facilities and services; a local library offering additional services such as reading groups, workshops and events; new facilities for families and young people; and a housing services centre offering rent and benefit advice.

Dave Higgins, Project Manager of Billington Structures, said:

"This is a very high profile project and we are proud to be involved in something that will have such a positive impact on the local community."

One coat solution for fire protection

Fire protection coatings manufacturer, Leighs Paints, has created a one product solution which it said will simplify fire protection, and reduce process costs.

FIRETEX FX1002 for onsite and FIRETEX FX2002 for in shop applications can now provide fire protection up to 120 minutes - creating a one product solution for a wide range of steel sections.

Simplifying the fire estimation and specification process, while also reducing the risks involved during application; one of FIRETEX FX1002/2002's advantages is said to be the ability to achieve a higher fire rating by simply changing the amount of coating applied, as opposed to changing the product completely. This is said to remove the need for multiple products, which ultimately reduces waste, process time and most importantly cost.

Leighs Paints Business Manager, Anthony Ward said: "Fire protection solutions are a great passion of Leighs Paints, and we continually work to develop our range to provide more competitive, cost effective solutions for our customers.

The improvements to FX1002 and FX2002 enable us to provide a competitive one product solution, which can reduce process costs and improve stock management - in an industry where time and price are so important; any reduction can give big advantages."

Health and Safety Regulations to be reformed

The BCSA attended the launch of the Government's major reform of Health & Safety regulations on Monday 21st March 2011.

The Minister for Employment Chris Grayling, along with a number of the Health and Safety Executive (HSE) board members rolled out the next phase of regulations which are aimed at reducing the burden on SMEs.

HSE Inspections will be reduced by one-third (circa 11,000), and the BCSA suggested that the good record of improvement in the constructional steelwork sector should help make such visits less likely.

A new web site, to make health & safety simpler for SMEs in low risk workplaces and explaining what they need to do to comply with regulations, was also launched. The Minister has ordered a review of all H&S legislation and he will make his proposals for simplification by autumn 2011.

The Department of Works and Pensions website has the latest news and progress on the review *http://www.dwp.gov.uk/policy/health-and-safety/*

Critical link in place for Cumbrian bypass

Birse Civils is completing the deck of a new 1,200t steel crossing of the River Eden north of Carlisle after Cleveland Bridge finished the steelwork erection.

The 156m long bridge forms an integral part of the Carlisle Northern Development Route, a five mile road linking the A595 with the M6.

To erect the structure Cleveland Bridge made use of one of the UK's largest mobile cranes. It lifted each of the structure's four longitudinal girders, each weighing 170t and including the 59m back span and around a third of the 97m main span, into place to balance on the bridge's single pier and east bank seat.

The crane was then dismantled and driven around to the western side of the bridge to lift in the remaining two main span sections, each weighing 250t.

The project is a £176M PFI contract between Cumbria County Council and Connect Roads.

Domed auditorium completes historic crescent

A new 450-seat concert hall, which will house the University of Birmingham's department of music, will complete the historic redbrick semi-circle of buildings which have been at the heart of the academic institution since 1909.

Known as the Bramall Building, the steel framed structure will feature a high-spec auditorium, a large rehearsal studio topped by a feature domed roof, teaching rooms and a large entrance foyer.

In order to replicate the adjoining structures the concert hall will be clad with red bricks, and stone specially sourced for its appearance. Arched windows and doorways as well as rooftop turrets will also mirror the university's historic buildings.

Working on behalf of main contractor BAM Construction, Robinson Steel Structures has erected approximately 700t of structural steelwork for the project.

"To erect the domed roof more than 600 individual steel members were used," commented BAM Construction Project Manager Scott Marsh. "The steel erectors had to use a temporary steel tower to support and stabilise the dome during erection and this couldn't be removed until the final member was in place."

The project is scheduled for completion by March 2012.

NEWS IN BRIEF

Schöck has been awarded a British Board of Agrément (BBA) certificate for its type KST thermal break element. The award was presented at the recent Ecobuild event and was for the product's steel-to-steel connectivity and related modular applications. Schöck said its Isokorb range is now unique on two counts; in addition to the BBA certification, it is the only thermal break range to allow connectivity between steel-to-steel, steel-to-concrete and concrete-to-concrete.

FLI Structures has been awarded a Steel Construction Sustainability Charter certificate for its high quality in management skills. The company also demonstrated high achievement for the correct requirements in the following areas of management expertise: a published sustainability policy; an accredited H & SMS to OHSAS 18001; an IIP accreditation or a structured programme for personnel training, development and communication; a published equal opportunities policy; a published ethical trading policy and an accredited QMS to BS EN ISO 9001

Hilti will be running open days on 13 April and 14 April at 21 Hilti Centres across the country. To find your nearest participating Hilti Centre go to *www.hilti.co.uk/hilticentre* The open days will allow visitors to purchase ex-demonstration tools at reduced prices, as well as getting hands-on with the tools to 'try before they buy'.

NASCC 'The Steel Conference' will take place at the David L. Lawrence Convention Center in Pittsburgh, USA from 11-14 May. For more information on the event visit website: *www.aisc.org*

Kingspan has had its production plant accredited to BS EN 1090 parts 1 and 2 and is able to CE Mark its products. CE Marked Multibeam and Multichannel sections are now available on request.

Highland takes the lead at Glasgow Velodrome

One of Scotland's leading galvanizing firms, Highland Galvanizers & Colour Coaters, has joined the winning team delivering the Sir Chris Hoy Velodrome in Glasgow.

Highland has the contract to galvanize 120t of structural steel at the state-of-the-art £92M velodrome, which is being built in tandem with the National Indoor Sports Arena for the 2014 Commonwealth Games. Cumbernauld-based Highland will also be bringing colour to the games complex by colour coating all of the external steel bollards and cycle racks at the velodrome after being appointed by project landscape architects Scott Wilson (Belfast).

The velodrome will have a permanent capacity for 2,000 seated and 500 standing spectators viewing the 250m cycle track, which will be increased to 4000 seats for the track cycling events at the Games.

Paul McCafferty, Sales Director of Highland, said: "The Sir Chris Hoy Velodrome will be an iconic structure in Glasgow for years to come and demonstrates Scotland is serious about its sport.

"As well as being a fabulous addition to Glasgow's sporting infrastructure, the velodrome is part of a world-class

development and is a highly sophisticated feat of engineering.

The main steelwork contractor for the project is Watson Steel Structures.

School project requires speedy and quiet construction

Lightweight prefabricated modular steel construction has been chosen as the preferred method to build a new block at Wensley Folds Primary School in Blackburn.

The infill block will tie into two existing buildings situated on either side. This, together with a sloping site and the fact that the school will remain open throughout the construction programme has called for much logistical planning.

Working on behalf of main contractor Eric Wright Construction, Engineered Off-Site Systems (EOS) is supplying pre-assembled wall frames and ceiling cassettes, all of which come to site fully fitted and ready for installation.

"There is very little access into the site so all of our prefabricated frames are bespoke units under 2.4m wide," explains Steve Donelon, EOS Contracts Manager.

The project team have also chosen the steel system for its higher load capacity and because the two storey frame is expected to be erected in under four weeks; a saving of four weeks to the overall programme.

Induction bending arrives at section benders

An Induction Bending machine has been installed at Barnshaw Section Benders, increasing the number of tube and section processes the company can offer.

The company said it can now bend sections to a much tighter radius and complete finished bends with very little cross sectional deformity.

The recently installed machine can produce bends ranging from four inch up to 28 inch in pipes as well as CHS members with wall thicknesses up to 30mm. The machine can also bend various RHS, SHS, eliptical sections, universal beams and columns.

The induction bending process uses an induction coil to heat a small part of the cross sectional area to create a narrow band that allows the section to be formed via the use of a controlled clamping and hydraulic system.

The machine uses an alternating electric current along with the conductive material properties to create the localised heat band. As the section is pushed through at a controlled feed rate, the material is constantly water cooled and this in turn forms the section at the required radius.

Diary

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For Steel Day: Scotland contact Gillian Mitchell
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12 April 2011
Steel building design to EC3
Sheffield

5 May 2011
Portal Frame Design
Bristol

10, 17, 24 May 2011
On-line Steel Building Design to EC3 Part 1
On-line course

5 May 2011
Steel Day: Scotland
Joint BCSA / IStructE Scottish Branch CPD event
Aimed at members of both organisations, this event looks to promote closer links through better understanding of the design and fabrication process. A combination of factory tours facilitated by BCSA Members, followed by a series of short lectures at Stirling University.

Half Day Seminars for Engineers
8 June 2011
Southampton
9 June 2011
Bristol
22 June 2011
Birmingham
23 June 2011
Liverpool
Register your initial interest by emailing events@steelconstruction.org

Working in close proximity to a 'live' airport has been a logistical challenge for the construction team

Terminal extension due for arrival

Additional space for check-in desks and baggage reclaim belts is being created with a steel framed extension to Gatwick Airport's North Terminal. Martin Cooper reports

More and more people are taking to the skies each year. Whether it is for business or pleasure and no matter what the current economic climate may be, passenger numbers at most UK airports are increasing on an annual basis.

To cope with these extra passengers construction of new facilities are being undertaken at a number of airports around the country, including Gatwick, where a raft of on-going developments will enlarge and transform the North Terminal.

Extra capacity and more space are key elements in Gatwick Airport's wide-ranging redevelopment plans, and the North Terminal is being extended along its southern and eastern elevations to create additional check-in capacity and baggage areas.

Forming part of Gatwick Airport's North Terminal Landside Development Programme, the extension, which is due to be completed by the end of the year, will allow the terminal to increase its annual capacity from 14M to approximately 24M passengers per annum.

The project began in March 2008 when structural engineer WSP initiated the design process. On site, construction kicked off last year and working within an extremely busy 'live' airport has meant a number of challenges have had to be overcome.

Planning and logistics play an integral role on all large construction projects, but working on large international airports requires a little more pre-planning than normal. As the extension adjoins the existing terminal building, there is little room for materials to be stored, and consequently most are delivered on a 'just-in-time' basis.

This includes the delivery of steelwork to site, all 2,600t of it has been delivered and erected by Fisher Engineering on a tight programme which was completed during March.

Gatwick moves with the times

As well as the extensions being added to the North Terminal, other developments are also on site or already complete at the South Terminal and on the Airfield, as part of Gatwick's £1bn investment programme. At the North Terminal, connecting into its extension is an inter-terminal shuttle service which now has a new steel-framed interchange (see NSC April 2010). This was completed last year and associated works include a new short stay car park, a reconfigured forecourt and a new baggage handling system.

The eastern extension is 100m long and formed with box section girders

As the original terminal building is a steel framed structure, connecting the new steel braced extension has required a myriad of steel to steel connections.

Some of these connections have required the contractor to stiffen up existing steelwork so it could accept the extra loads from the new steelwork. As the existing steelwork is obviously connected to and inside the functioning North Terminal building this work has been undertaken during the night.

"Before we could install some trusses for the extension much of the adjoining and supporting steelwork of the old terminal building had to have 150mm thick cleats attached so it could carry the new steelwork," explains Fisher Engineering Project Manager Robin Hamill. "Welding these plates into position had to be done from 10pm to 4am to avoid disruption to the airport."

The new extension is L-shaped in plan, with the shorter part of the 'L' wrapped around the southern elevation and the eastern portion being a long structure adjoining the terminal's eastern main facade.

Attaching a new portion of structure to the southern corner of the terminal threw up some interesting challenges almost immediately.

In order to make the southern extension seamlessly blend into the existing building's 10.8m grid, the first line of columns had to be installed right up against the old terminal. However the existing building's piled foundations meant the new columns couldn't be founded in the desired locations and so cantilever foundations had to be installed.

"One line of columns is supported on steel cantilevering ground beams," explains WSP Associate Director Ben Karunasekera. "Steel beams offered two advantages: first they were only 700mm deep, which gave us ample clearance of underground services and secondly, erecting the columns was subsequently easier with a steel to steel bolted connection."

Existing foundations and services were not the only obstructions that had to be avoided during the construction process. There is a vehicular service tunnel running beneath the footprint of the southern extension, and this required careful positioning of columns in order to maintain the desired grid pattern.

Complicating the matter even more, passengers arriving at the North Terminal are also walking right across the southern extension's footprint, albeit inside a temporary enclosed passageway.

Steelwork erection was carried out over and above this protected passageway, with cherrypickers positioned either side of this structural barrier. A new suspended walkway, which ties into the extension's columns and is hung from the roof of the middle level, will eventually replace this temporary passageway.

The southern portion of the extension features three levels: ground floor (Level 0) for arrivals; first floor (Level 10) avenue level which will have shops and restaurants (this level connects into the revamped inter-terminal shuttle station), and second floor (Level 20) departures.

The upper floor (departures) is more open →

FACT FILE
Gatwick Airport North Terminal extension

Main client: Gatwick Airport
Architect: Capita Architecture
Main contractor: Morgan Sindall
Structural engineer: WSP
Steelwork contractor: Fisher Engineering/ Watson Steel Structures
Steel tonnage: 2,600t
Total Project value: £83.4M

Cellular beams spanning in an east-west direction and trusses spanning north-south create the open plan departures area

plan than the two floors beneath. In order to create this spacious floor plan two lines of internal columns are missing at this level and two 30m-long Westok cellular beams span this larger void. Cellular beams were chosen for their economic performance, and importantly at one end of the structure services do pass through the web openings.

The cellular beams were brought to site in 15m long sections, before being erected as one bolted up 30m long beam.

"As well as being economical the cellular beams were chosen as they are only supporting the roof of Level 20, which in turn is a relatively light structure as there is no plant area in this location, compared to other rooftop areas," adds Mr Karunasekera.

Also within this section of rooftop steelwork there are maintenance walkways accommodated within two 2.1m deep trusses which span east to west (opposite to the cellular beams) across the roof of Level 20.

"One line of columns is supported on steel cantilevering ground beams."

Creating a similar column free space in the opposite grid direction from the cellular beams, the trusses were fabricated at Fisher's facility as complete sections ready to be erected on site. "The longest truss is a 21m-long section, weighing 16t," explains Mr Hamill.

The eastern portion of the extension will bring the terminal building out and over the existing raised ramp; a structure which was previously the main access route to the terminal's entrance. This ramp is now closed for security reasons - vehicles must now remain 30m away from the terminal building - and the main access into the revamped North Terminal will be via the shuttle station, which is situated between the Sofitel Hotel and the Short Stay Car Park.

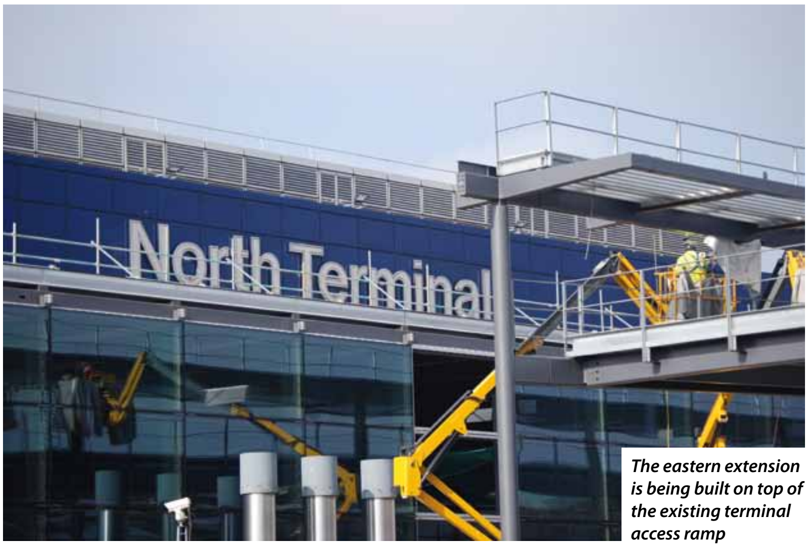
This sector of the extension comprises of one single level which is 20m wide and approximately 100m-long. One external row of columns is spaced at 20m intervals and a series of box sections then connects to the steel frame of the existing terminal structure.

Fabricated box sections form this braced steel frame and they were erected to span this part of the project because to their aesthetic appeal, compared to traditional rafters. Because of the length of this part of the extension, each 20m span contains a movement joint connecting back into the existing steelwork.

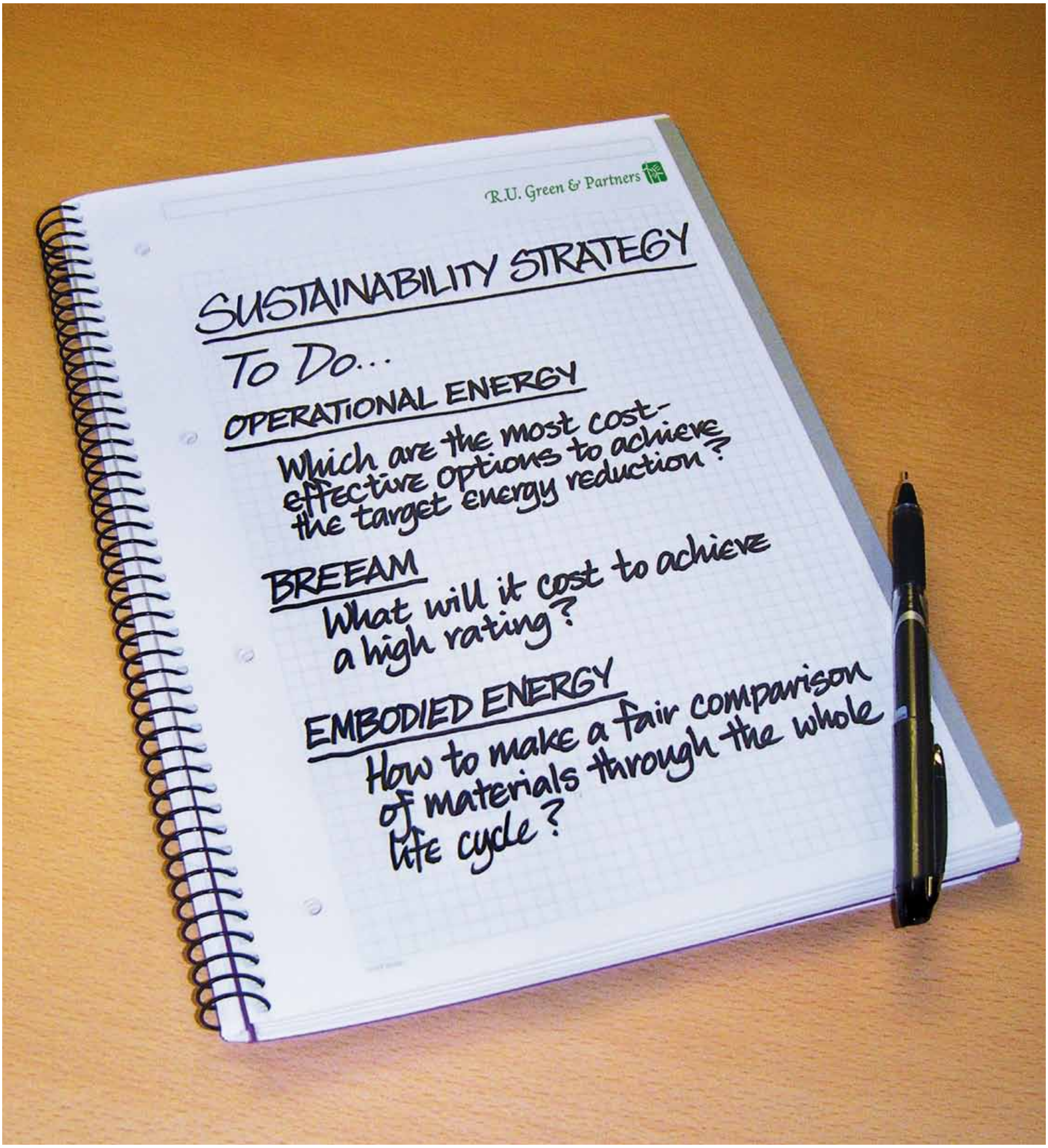
Each box section was fully fabricated at Fisher's facility and brought to site in the required 20m-long pieces. For this part of the project, night time welding was again required, as stud connections had to be installed onto the existing steelwork so it could accept the box sections.

The long east extension structure will be fully glazed with blast resistant laminated glass panels, fully compliant with current security regulations. In order to accommodate this glazing, all of the steel connections are hidden for an architectural finish, while the steelwork was fabricated and erected to an extremely high tolerance.

The North Terminal extension is due to be completed by the end of the year and, together with the Airport's other projects (see box on previous page), it will provide the necessary extra space and capacity Gatwick needs for its future plans.



The eastern extension is being built on top of the existing terminal access ramp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The structure could accommodate 20 football pitches inside its large cavernous interior

Big is best for distribution

A new eco-friendly distribution centre for B&Q is rapidly taking shape on the outskirts of Swindon. NSC reports on a project where steelwork is helping to create a town's largest building.

The largest building in Swindon is rapidly nearing completion on a new industrial zone known as Gazeley G-Park. Measuring 392m x 183m, the new B&Q distribution centre is not just big, it will incorporate a number of sustainable features and, importantly for the town, it will also create 600 new jobs.

Constructing a mammoth structure like this one requires lots of logistical planning and a colossal amount of materials - in this case 2,400t of structural steelwork. Large numbers do not finish there; the total amount of cold rolled steel elements used on the project, such as purlins and rails, add up to 29,000 individual items, which equates to a combined length of some 70km.

Located adjacent to the A419, this new strategically located regional hub will service B&Q stores in the south of the UK. The large structure will also incorporate a number of eco-friendly features such as rainwater harvesting from the expansive roof, solar panels to heat water and a solar wall which will use renewable energy to heat and ventilate the building. The overall development will also include substantial areas of new habitat around the building with the planting of approximately 500 trees.

Under an existing legal agreement attached to the outline planning permission, Gazeley will also make a contribution of £150,000 for the provision of public art and £700,000 to be invested in the Great Western Community Forest.

Construction of the distribution centre has moved on in leaps and bounds since developer Gazeley was granted planning permission last year. Since then the plot has been transformed by main contractor McLaren Construction, with the warehouse due to be operational by the end of the year.

Work started in earnest last September with the greenfield site being cleared and readied for the steel erection to begin. Steelwork contractor Caunton Engineering then began its steel programme during November, a task that was completed by March this year.

Working on a design and build contract for the steel, Chris Duff Caunton Engineering Project Designer says the main challenge was the structure's size. "The steel frame looks straightforward, just extremely large. However, many of the portal frames are designed differently because of the loadings."

The structure consists of six 32m spans, with bays that are generally 8m wide along its entire length. But some of the bays are slightly smaller, because of their locations as Mr Duff explains. "At one gable end there is an internal office block, then some bay centres alter for architectural reasons. Then further down the building there are external canopies on either side of the building which exert loadings that require the portal frames to be designed differently by altering the bay sizes."

Each portal frame span is formed with

The steel erection programme has allowed other follow-on trades to start on time

Steel canopies are positioned along two elevations exerting extra loads onto the main frame

FACT FILE
B&Q Distribution Centre, Swindon
Main client: Gazeley
Main contractor: McLaren Construction
Architect: Chetwood
Structural engineer: Hydrock
Steelwork contractor: Caunton Engineering
Steel tonnage: 2,400t

457 section rafters brought to site in 16m lengths. Two of these sections were bolted together on site and lifted into place as one piece to form each of the six spans. Overall, the structure reaches a maximum height of 16m to the eaves.

Supporting each of the portal spans are 533 x 312 UKBs, chosen by Caunton because these Advance sections give extra stability while giving the client more floorspace because they are not as deep as traditional beams.

Another architectural feature of the building's design is the positioning of the roof's sprinklers which run parallel to the purlins. Positioning the service pipes along the rafters and not the eaves means there are more loads being transferred to the columns than would normally be expected.

"To accommodate these extra loadings the column sizes are slightly larger than would otherwise be needed," says Mr Duff.

Apart from the rafters for the large spans, the majority of the project's steelwork arrived on site in erectable loads. When steel erection began Caunton had most of the site, or at least the portion taken up by the building's footprint, to itself.

Working from the gable end, which incorporates the internal office block, steel erection proceeded down the structure, with Caunton erecting eight bays per week. The company had three 25t capacity mobile cranes on site, plus 14 cherrypickers for the erection programme, and more than 350t of steel was erected every week.

Once the initial eight bays of steelwork was completed, the cladding contractor was able to start its installation programme.

"In this way we had a sequential working programme, as our quick erection allowed the follow-on trades to get started on time," comments James Bibby, Caunton Contract Manager.

Heavy snow during December affected the entire country and most construction projects lost valuable time. On this job steelwork erection was able to continue for the most part, as the roads were kept clear for deliveries and the site was suitably safe for the erectors to keep working.

Once the majority of the main frame was completed, the final two elements of the steel programme consisted of the erection of a separate 25m x 25m portal framed recycling centre, located adjacent to the distribution warehouse, and the two external canopies.

One canopy runs the entire length of one elevation, while on the opposite side of the building there is a shorter but similar canopy.

Supported on 8m high columns, spaced at 36m intervals, the tip of both canopies is formed from a 0.5m deep box section truss. Sections of the truss were brought to site in 18m lengths and then assembled on the ground into the necessary erectable lengths.

Connecting the truss back to the main structure are a series of 8m long rafters, which in turn support the canopy's cladding.

"The steel frame looks straight-forward, just extremely large. However, many of the portal frames are designed differently because of the loadings."

Steel proved to be the economical solution for the complex roof design

Steel roof on patrol

A new Thames Valley Police traffic base features a geometrically challenging roof, a structure which could only have been constructed economically with steel.

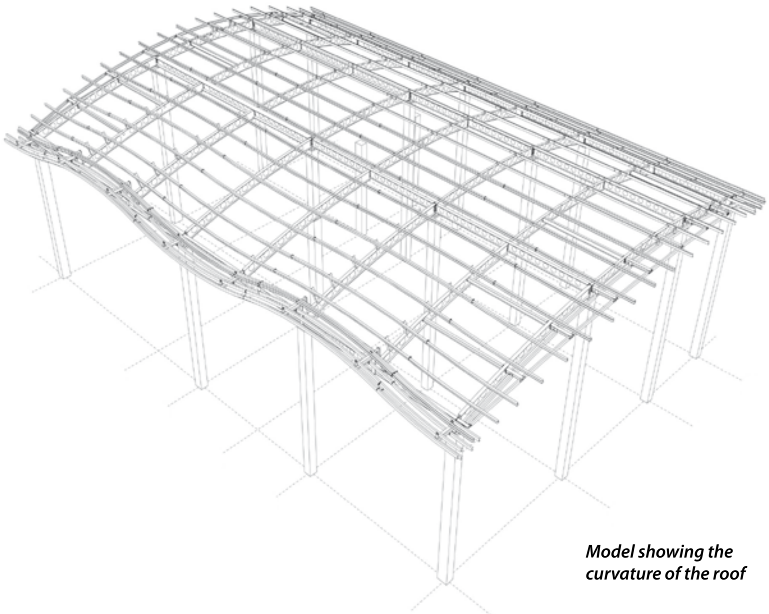
FACT FILE
Taplow Police Traffic Base, Berkshire
Main Client: Thames Valley Police
Architect: ttsp
Main contractor: Willmott Dixon
Structural engineer: AECOM
Steelwork contractor: Crown Structural Engineering
Steel tonnage: 50t

Under construction on the site of the old premises, the Buckinghamshire village of Taplow will soon have a new roads policing base and office, one which is adorned and topped with a highly challenging curved steel roof.

Located a few miles to the north of Maidenhead, Taplow is not an area renowned for high-rise buildings or tall structures. However, by topping its three-storey police building with a curving roof, the new building - which is the tallest in its vicinity - will minimise the visual impact on the surrounding area while being a signature structure within the village.

With an overall floorspace of some 2,400m^2, the police building features a ground floor parking area with administrative offices alongside, while the upper two levels accommodate more office space. Structurally the building has a cast in-situ concrete frame which is then topped with the steel formed wave-like roof.

Explaining the rationale behind the project's hybrid concrete and steel design, ttsp Architect Darren Stacey says: "When designing the project we quickly realised the only economical way we could achieve the desired curving roof was to use steel.



Model showing the curvature of the roof

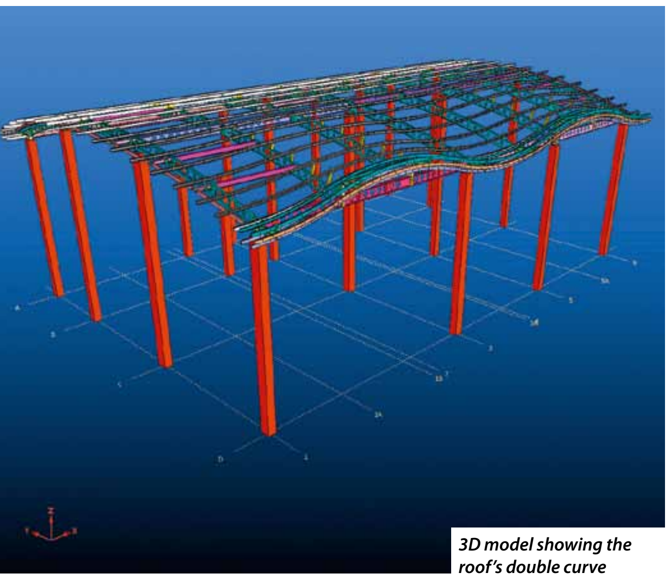
"It has a double curve and would have required a lot of formwork to achieve this shape using concrete. The cost comparison led us to steel."

The building is founded on a series of 20m deep piles which in turn support the slab and the concrete frame. The building's entire frame was completed, by main contractor Willmott Dixon, prior to steelwork contractor, Crown Structural Engineering, starting its steel erection programme.

This sequence allowed the steel erection team to work off of the completed concrete deck which forms the floor of the building's second storey. Concrete columns were cast up to roof height and the steel structure is connected to these at ceiling level via holding down bolts. →

Steelwork connects to the concrete frame at roof level

The new police station will be open prior to the Olympics and will be a landmark structure for Taplow



3D model showing the roof's double curve

Spanning the building's width are eight identical steel curved cellular beams which form a barrel vault shape. Chosen for economic and cost reasons, the cellular beams were curved into the necessary shape during their fabrication process.

"Traditional beams would have had to have gone through a bending process, by choosing cell beams we cut down on a required process and saved the client money," says AECOM Project Engineer David Cuckow.

Supported on the cellbeams and creating the roof structure's double curve are a series of extended cleats to support the curved PFC purlins positioned perpendicular to the main rafters. These hot rolled purlins are all set at different positions to form the undulating shape.

> *"When designing the project we quickly realised the only economical way we could achieve the desired curving roof was to use steel."*

As well as having the longitudinal double curve, one of the gable ends splays outwards, forming an 'eyebrow' over the main entrance area. To create this complex shape, where the roof is in fact sloping in three directions, the purlins' radii have to change at every purlin line to ensure stability of the shape. The shape consequently requires every purlin connection to be a moment connection to the rafters.

"The double curve actually flattens out slightly as the roof reaches its apex, again complicating the design," says Crown Project Designer Richard Noble. "Without 3D modelling a structure like this would have been extremely difficult to design."

Mr Cuckow agrees and says: "Defining the geometry for the roof was the biggest challenge associated with this project."

The roof also features three spine beams, one directly central and acting as an apex beam. All of these members are also cellular beams, but these were formed from three separate sections as their profiles change along their lengths.

"Another challenge was getting all of the cellbeams to line up in both directions, with no purlin locations near to any of the beam holes," adds Mr Noble.

Designing the roof was not the only challenge faced by the design team, they also had to make sure the cladding system, in this case an upstanding seam, could be installed over such an unusual shape.

The cladding contractor had to be liaised with at an early stage and a full-size mock-up of the roof's 'eyebrow' section was constructed. This then allowed the cladding contractor to get its product and erection sequence correct for the double curve area prior to starting on site.

By producing the mock-up, the design team were able to ensure the roof's steel design worked for the cladding, and the curves allowed rainwater run-off.

Once on site Crown erected the entire steel roof in two weeks, which allowed the cladding contractor to start its work on schedule.

Due to be completed during the Summer, Taplow's new police building will have a key role to play during the London 2012 Olympics due to its close proximity to Dorney Lake (rowing venue), and its highly visual curving roof will make it a legacy structure in the Buckinghamshire village.

Swing bridge slides into place

Eight masts support the bridge's cables

Symbolising regeneration, Media City's steel swing bridge was constructed from modular sections, while the deck was launched into position via an innovative sliding procedure.

FACT FILE
Media City Footbridge, Salford
Main Client: Peel Holdings
Architect: Wilkinson Eyre
Main contractor: Balfour Beatty Regional Civil Engineering
Structural engineer: Gifford
Steelwork contractor: Rowecord Engineering
Steel tonnage: 410t

Spanning the Manchester Ship Canal, the £8.3M state of the art Media City Footbridge provides pedestrian access into the heart of Salford's fast expanding Media City Development.

Covering a large portion of former docks and quays, the development will soon be the home for several BBC departments, while a host of other media and production companies are expected to relocate there in the near future.

The bridge links the Media City site with South Quay, adjacent to the Imperial War Museum North. As well as enhancing access between the two sites, the bridge has also been designed to be a symbol of regeneration and a marker for further development.

The design of the Media City Footbridge is far from being run-of-the-mill as this asymmetric cable stayed structure's main span pivots through 71 degrees to allow large vessels to pass along the canal. Choosing a swing bridge design over a fixed crossing was one of the main design issues, and the choice was made as there is a public right of navigation along the Canal. Although ships don't enter the Port of Manchester as regularly as they once did, the bridge design had to accommodate any possible ship movements.

Structurally the bridge comprises two spans; the main pivoting span crossing the Canal is 63m long, with a short back span of 18m. The back span was constructed as a hollow steel box and then filled with concrete to form the bridge's counterweight for balancing the main span during opening.

The main span's deck is fabricated as a shaped internally stiffened orthotropic steel box, with pedestrians walking on an epoxy aggregate applied coating. The deck box is a fully welded structure and sealed against the ingress of moisture, making the internal areas maintenance free.

The asymmetric form of the bridge's deck span utilises a fanned array of eight, shaped CHS steel masts which converge at their bases atop a sculpted pedestal. The masts are up to 30m tall and support the bridge deck via high tensile steel cables anchored to the east side of the deck.

The deck is supported at 6m centres by the steel cables, which are anchored at their upper and lower ends using fork connectors onto steel outstand lugs aligned in the plane of the stays at the mast tip and deck connections.

"The most economical method of constructing this bridge was to fabricate as much of the structure off-site as possible," explains Rowecord Engineering Contract Manager Gareth Summerhayes.

To achieve this steelwork contractor Rowecord fabricated the majority of the structure in modular sections, which were then brought to site to be welded together and assembled adjacent to the bridge's final position.

The main span, which has a width that fans out from 6m to 18m, was fabricated in

Sliding a bridge into position

The slide procedure for the main span was carried out over 36 hours and involved jacking up the structure approximately 500mm off its temporary supports onto a skid track system that incorporated a pair of 40m-long 'Kursk' beams.

The steel beams are referred to as 'Kursk' beams as they were used as part of the recovery operation in 2001 to raise the Russian submarine of the same name.

"This procedure was used as it allowed us to fully assemble the bridge sections on the quayside without having to work over the water," says Rowecord Contract Manager Gareth Summerhayes.

Finally the structure was jacked down onto its slew ring bearings where it will pivot using six hydraulically operated drive motors to rotate the bridge between its open and closed positions.

A similar procedure was then undertaken to move and position the smaller backspan of the bridge, which had been filled with counterweight concrete and consequently weighed more than 100t.

three sections, while the shorter backspan was fabricated as one section. All steel sections had two coats of paint applied at the factory, and then a further two were applied once the welding had been completed.

Prior to the spans being assembled Rowecord first had to install the steelwork for the pivot bearing. The pivot for the bridge comprises a large steel casting welded into the pivot zone of the steelwork deck and mounted on a slewing bearing, which in turn is supported on a fabricated steel structure.

This arrangement provides vertical support; resists the overturning moment generated about the horizontal axes and also provides horizontal restraint during bridge rotation.

"We then slide both of the spans into position, with the main span first and then the backspan," says Mr Summerhayes, (see box story). "Once these were in position we were then able to erect temporary works to allow the masts and cables to be erected and installed."

With temporary works supporting the spans, as well as beam and column steel works supporting the masts, the cables were attached and correctly tensioned. Only when all of the cables were in position were the temporary works removed.

Summing up the project, Mr Summerhayes says: "This was a unique project from start to finish. Not only was the slide procedure and construction method slightly unusual, but the bridge's design is also unique as the deck is curved in plan and elevation."

This asymmetric cable stayed structure's main span pivots through 71° to allow large vessels to pass along the canal.

Artistic vision of completed bridge and development

Temporary works were installed while the bridges' masts were all erected. These works had to remain in place until all the cables were attached

Bespoke portal frame rises quickly

Needing a steel frame capable of supporting different loadings, a distribution centre in Enfield also required a frame which could be designed and erected in quick time. NSC reports.

Despite severe weather conditions steelwork was completed on time

FACT FILE
Tesco Distribution Centre, Enfield
Main client: Gazeley
Architect: Ashton & Smith Associates
Main contractor: VolkerFitzpatrick
Structural engineer: Capita Symonds
Steelwork contractor: Hambleton Steel
Steel tonnage: 500t

Speed is of the essence for all construction projects, big and small. Time equates to money for clients and contractors alike and all jobs are required to be completed as quickly as possible. In order to satisfy these common contractual demands, much thought is always given over to what materials are used and what materials can best deliver the project on time, or even better - deliver the project early.

A new Tesco distribution centre in Enfield perfectly sums up these criteria as 500t of structural steelwork was successfully erected in just five weeks, ensuring that all of the follow-on trades were able to start on schedule, and that the entire job is on course for its handover in August.

Spanning a warehouse that measures 172m × 82m, the steel portal frame for this project needed to be a bespoke design, as various loadings will be exerted on the steelwork at numerous points because of the internal equipment which will be installed.

"These large distribution warehouses are usually built with a steel frame in this country," says Matt Ghinn VolkerFitzpatrick Project Manager. "On this job it had to be steel as no other framing material could have been completed in such a tight timescale.

"The frame will be supporting overhead chillers as well as refrigeration equipment and its pipework. This required a design where many of the portal frames are different, something which can be done with steel."

Steelwork contractor Hambleton Steel began its programme prior to the Christmas break and completed in February. As well as having to go off site during the festive break, the company also had to contend with some very inclement weather during December, which makes its speedy completion all the more impressive.

Overall, construction work began a few weeks earlier in November when VolkerFitzpatrick carried out a vibro-piling programe, which then allowed the main structure to be erected. The site, which is adjacent to the M25, had been cleared of its original buildings a few years ago and had stood idle ever since.

Covering an area of nearly 14,000m^2, the rectangular shaped distribution warehouse

Many of the portal frames will support internal plant equipment

Hambleton's erectors were able to get off to a good start and handed over four bays of the structure to the cladders at the end of the first week.

is a portal frame structure with three main spans of 27.6m, reaching a maximum height of 10.5m. Along the two main elevations of the building there are 23 bays with most columns spaced at 7.5m intervals.

Two of Tesco's businesses will make use of the warehouse; Tesco.com and Tesco Express. Approximately two-thirds of the building will be used by Tesco.com, with an internal firewall dividing up the structure.

Each portal span was brought to site in two pieces, which were then assembled on the ground into 27.6m lengths and lifted into place as one section. Starting at the northern end of the warehouse and erecting the lines of columns and overhead rafters in sequence to form the portal frames, this allowed the cladding programme to follow on right behind the steelwork erection.

Hambleton's erectors were able to get off to a good start and handed over four bays of the structure to the cladders at the end of the first week. Sequencing of the construction programme did not end here, as the steelwork erectors were always following on behind the ground works team.

"There are ten different frame designs to accommodate the various loadings in this warehouse," explains Hambleton Steel Technical Manager Chris Burns. "We have a blanket loading of 0.35kN/m^2 for the majority of the building, but this increases to a maximum of 0.65kN/m^2.

"The northern end of the building has some of the heaviest loadings because these frames will support chillers, while most of the area occupied by Tesco Express also features increased loadings."

Designing each portal individually may have been slightly more time-consuming for Hambleton's design team, but it has the benefit of making the overall steel design more economic.

"By designing each portal frame separately we were able to reduce larger rafter sizes where we could," adds Mr Burns.

The Tesco.com sector of the warehouse incorporates a mezzanine level for office space and a ground level staff canteen. Hambleton installed the mezzanine with its main steelwork package along with the associated metal decking and precast stairs.

The entire warehouse is not regimentally rectangular as within the part of the structure to be occupied by Tesco Express there is a vehicular driveway and entrance, which takes up one corner of the building. To allow for this the warehouse is slightly narrower at this end with just two spans - 26m and 27.6m.

Another feature of the project to incorporate extra loadings for supporting plant equipment is a service canopy which stretches along one of the main elevations. The canopy is 9.5m wide and attached to the main frame steelwork. It is formed with a combination of 533 and 610 beams, acting as main rafters and transfer beams.

"We had to design a slightly different column spacing for the canopy as there was an architectural restriction on some column spacings," explains Mr Burns. "Consequently the canopy steelwork is based around a larger 12.5m spacing."

The Enfield Tesco distribution centre is on course for its completion in August, a date that includes fit-out. Steelwork has played a significant role in the project's progress, not only as the frame was erected in five weeks, but the lead-in period for its design was finished in just six weeks.

The steel design incorporates a mezzanine level

Cladding followed on immediately behind the steel erection

Full marks for steel frame

A new campus building, incorporating three lecture theatres, is under construction at John Moores University in Liverpool. Martin Cooper reports on a project relying on steel's long span qualities.

FACT FILE
John Moores University, Mount Pleasant Campus, Liverpool
Client: John Moores University
Architect: ADP
Main contractor: Wates Construction
Structural engineer: Curtins
Steelwork contractor: Billington Structures
Steel tonnage: 860t
Project value: £19.5M

Work is currently progressing apace on a new building for Liverpool's John Moores University. Situated on the Mount Pleasant Campus, and overlooked by the Liverpool Metropolitan Cathedral, the six-storey steel framed structure incorporates three large lecture theatres and will ultimately serve the faculties of business and law, media arts and social science.

As with many inner city construction projects, this job has had to contend with a number of logistical issues, due to the site's extremely tight footprint and the proximity of busy roads. "We've also had to deal with some very strong winds over the winter," says Wates Construction Project Manager Tony Foster. "However, our team is working proactively to overcome all of these challenges to deliver an exceptional facility for the University."

Materials to site, including the steelwork, have all been delivered on a 'just-in-time' basis, due to site constraints. Little or no storage space is available on this project, and apart from the area where the project team has its cabins, the new structure occupies nearly all of the footprint.

"We've actually borrowed a small piece of land from the adjacent school. Here we can store some materials and position a crane when necessary," adds Mr Foster. This gesture from the school will be reciprocated once the project is completed. Pupils at the school are holding a landscape design competition.The winning entry will be given to Wates and it will then landscape the plot to the design before handing it back to the school.

Helping with the regeneration of adjoining plots of land is just one facet of this project, another is the previously alluded to close proximity of thoroughfares and pedestrians. For this reason the site has made sole use of mobile cranes for all on-site lifting duties.

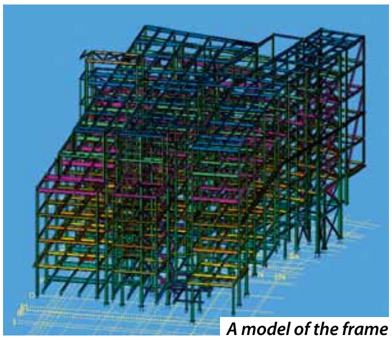
"With a tower crane we'd be over slewing the adjacent roads which could be dangerous; with mobile cranes we can adjust the machine's position and negate this hazard," adds Mr Foster.

This logistical decision has meant all steelwork for this project has been erected by a combination of mobile crane and cherrypickers.

Work started on site last year with Wates first undertaking the demolition of an old five-storey university block. The new block covers the same footprint, but is one level taller and also features a three level basement area. This underground level required a large scale excavation programme before the installation of concrete retaining walls and rock anchors to form the subterranean floor.

The basement does not have a uniform slab as it actually incorporates three different levels, two of which are occupied by a large lecture theatre.

The close proximity of roads has meant all steelwork has been erected by mobile crane



A model of the frame

One of the main reasons for choosing a steel frame for this project is the number of transfer structures needed to form the large open spaces for the three lecture theatres. As well as the basement theatre, there is another one at ground level and a further theatre at level three.

Architecturally, the structure also features two cantilevering façades, which would have also been difficult to form in anything other than steel," adds Curtins Project Engineer Andy McFarlane.

To stabilise the structure there are four steel braced cores, housing lifts and staircases, located throughout the building and sway frames along all elevations. Structurally the building is split into two sections, divided by a large glazed atrium. Both sections are structurally independent and linked by a series of steel footbridges which span the atrium.

Because of the tight footprint steelwork contractor Billington Structures had to erect the project sequentially starting at the northern end of the site.

The building's top two floors step in slightly to form an architectural feature

Initially a portion of the structure, equating to approximately one-third of the total footprint, was erected up to the topmost sixth level and fully decked.

"Some of the lower steelwork had to be temporarily propped for stability," says Paul Hayes, Billington Structures' Contract Manager. "Once steelwork was erected above third level its own bracing provided the stability and the props were removed."

Billington then erected the rest of the main frame in two more phases, which also incorporated the atrium and the column free theatre spaces. The largest of the building's theatres is located on the third floor. To create this space one large 25m-long truss supports the fourth floor level above. The truss was not installed as one piece because it would have been too big to manoeuvre around the site. Instead the entire bottom boom was erected as one, and then all other members were individually bolted into place.

During the second phase of the steel erection programme, Billington started constructing the cantilevers which are located along one main elevation and separated by the atrium. Starting at first floor level, the cantilevers are 6m and 5.8m wide respectively, and extend up to level four and level five.

"We erected the cantilevers separately as the structure was by then sufficiently braced that no propping was needed," explains Mr Hayes. Bearing in mind the busy thoroughfare that lies adjacent to and beneath the cantilevers, propping would have caused a hindrance to the pedestrians.

The campus building is due to be operational for the autumn term 2012.

One of the main reasons for choosing a steel frame for this project is the number of transfer structures needed to form the large open spaces for the lecture theatres.

Impression of completed building showing the two cantilevering façades

The "General Method" of EN 1993-1-1

Clause 6.3.4 of EN 1993-1-1 describes a "General Method" for lateral and lateral torsional buckling of structural components, ideally suited to software applications. Although the UK National Annex places some limitations on the use of this method, it is possible that the approach will become more widely used. In the first of two articles, Dr.József Szalai, of ConSteel Solutions Ltd describes the background to the method.

Element design

When verifying the stability of beam-columns (members under combined axial load and bending) there are three different procedures in the current version of EN 1993-1-1:

1. An imperfection approach described in Sections 5.2 and 5.3
2. An isolated member approach described in Sections 6.3.1, 6.3.2 and 6.3.3
3. The so-called general method described in Section 6.3.4

In the first approach the structural model is subjected to appropriate geometrical imperfections and after a completing a second order analysis only the cross section resistances need be checked (clause 5.2.2(7)(a)). This method is generally not used in practice due to the uncertainty in the definition of the shapes, amplitudes and signs of the equivalent imperfections. The second approach is the conventional engineering solution for buckling problems, but is limited to uniform members only with relatively simple support and loading conditions. The method is based on two essential simplifications:

- Structural member isolation: the relevant member is isolated from the global structural model by applying special boundary conditions (supports, restraints or loads) at the connection points which are taken into account in the calculation of the buckling resistance.
- Buckling mode separation: the buckling of the member is calculated separately for the pure modes: flexural buckling for pure compression and lateral-torsional buckling for pure bending, and the two effects are connected by applying special interaction factors.

Although EN 1993-1-1 provides direction on the calculation of interaction factors in Annex A and Annex B, the choice of appropriate buckling lengths for complex problems is left entirely to the engineer.

The general method is a new approach for stability design and only appeared late in the development of the Eurocodes – the general method did not appear in the draft of 1992, for example. The basic idea behind the general method is that it no longer isolates members and separates the pure buckling modes, but considers the complex system of forces in the member and evaluates the appropriate compound buckling modes. The method offers the possibility to provide solutions where the isolated member approach is not entirely appropriate:

1. The general method is applicable not only for single, isolated members but also for sub frames or complete structural models where the governing buckling mode involves the complete frame;
2. The general method can examine irregular structural members such as tapered members, haunched members, and built-up members;
3. The general method is applicable for any irregular load and support system where separation into the pure buckling modes is not possible.

Although in the current version of the Eurocode the general method is recommended only for lateral and lateral-torsional buckling of structural components, the basic approach may be extended to other cases. A number of research projects are underway across Europe intended to verify and widen its applicability.

Description of the general method

The rules of the general method can be found in EN 1993-1-1 Section 6.3.4. Because the expressions and nomenclature within this Section of the Standard are likely to be unfamiliar, a column buckling problem is firstly used as a simple example. The steps to verify the stability design of a compressed member according to the conventional isolated member approach are as follows:

- ***Step 1***
  Calculate the design value of the compressive force on the member
- ***Step 2***
  Calculate the compression resistance of the cross section of the member
- ***Step 3***
  Calculate the elastic critical compressive force of the member (N_{cr})
- ***Step 4***
  Calculate the member slenderness, $\bar{\lambda}$ and the reduction factor, χ
- ***Step 5***
  Calculate the design buckling resistance of the member.

	Isolated member approach	General method
Step 1	N_{Ed}	N_{Ed}
Step 2	$N_{c,Rk}$ – Eqs. 6.10 - 6.11	$\alpha_{ult,k} = \frac{N_{c,Rk}}{N_{Ed}}$ – Section 6.3.4(2)
Step 3	N_{cr} – Section 6.3.1.2(1)	$\alpha_{cr,op} = \frac{N_{cr}}{N_{Ed}}$ – Section 6.3.4(3)
Step 4	$\bar{\lambda} = \sqrt{\frac{N_{c,Rk}}{N_{cr}}}$ – Eq 6.49 $\chi = \frac{1}{\Phi + \sqrt{\Phi^2 - \bar{\lambda}^2}}$ – Eq 6.49	$\bar{\lambda}_{op} = \sqrt{\frac{\alpha_{ult,k}}{\alpha_{cr,op}}} = \sqrt{\frac{N_{c,Rk}}{N_{cr}}}$ – Eq. 6.64 Calculate χ_{op}
Step 5	$\frac{N_{Ed}}{N_{b,Rd}} = \frac{N_{Ed}}{\chi N_{c,Rd}} \le 1.0$ – Eq 6.46	$\frac{\chi_{op}\alpha_{ult,k}}{\gamma_{M1}} = \frac{\chi_{op}N_{c,Rd}}{N_{Ed}} \ge 1.0$ – Eq 6.63

Table 1

Table 2

	Isolated member approach	General method
Step 1	$N_{Ed,} M_{y,Ed}$	$N_{Ed,} M_{y,Ed}$
Step 2	$N_{c,Rk}$ – Eqs. 6.10 - 6.11 $M_{c,Rk}$ – Eqs. 6.13 - 6.15	$\alpha_{ult,k} = \min\left(\alpha_{ult,k,N} = \frac{N_{c,Rk}}{N_{Ed}}\ ;\ \alpha_{ult,k,N} = \frac{M_{c,Rk}}{M_{Ed}}\right)$ – Section 6.3.4(2)
Step 3	N_{cr} – Section 6.3.1.2(1) M_{cr} – Section 6.3.2.2(2)	$\alpha_{cr,op} = \min\left(\alpha_{cr,N} = \frac{N_{cr}}{N_{Ed}}\ ;\ \alpha_{ult,k,N} = \frac{M_{cr}}{M_{y,Ed}}\right)$ – Section 6.3.4(3)
Step 4	$\bar{\lambda}_z = \sqrt{\frac{N_{c,Rk}}{N_{cr}}}$ and hence χ – Eq 6.49 $\bar{\lambda}_{LT} = \sqrt{\frac{M_{c,Rk}}{M_{cr}}}$ and hence χ_{LT} – Eq 6.56	$\bar{\lambda}_{op} = \sqrt{\frac{\alpha_{ult,k}}{\alpha_{cr,op}}}$ and hence χ_{op} – Eq. 6.64
Step 5	k_{zy} – Annex A, Annex B	—
Step 6	$\frac{N_{Ed}}{N_{b,Rd}} + k_{zy}\frac{M_{y,Ed}}{M_{b,Rd}} \leq 1.0$ – Eq 6.62	$\frac{\chi_{op}\alpha_{ult,k}}{\gamma_{M1}} \geq 1.0$ – Eq 6.63

In Table 1 the above steps are summarized using the expressions and nomenclature of the conventional isolated member approach. The second column indicates the equivalent approach according to the general method.

In this example the general method is seen as a simple rephrasing of the expressions in which the key steps of the generalization are ***Step 2*** and ***Step 3*** where the forces are replaced by suitable load amplifiers. In order to see clearly the real meaning and significance of this generalization the following example examines the steps of the stability design of a member subjected to compression and bending where the relevant buckling mode is the interaction of minor axis flexural and lateral-torsional buckling:

- ***Step 1***
  Calculate the design values of the compressive force and bending moment on the member
- ***Step 2***
  Calculate the compression and bending resistances of the cross section
- ***Step 3***
  Calculate the pure elastic critical compressive force according to minor axis flexural buckling (N_{cr}) and the pure elastic critical bending moment of the member (M_{cr})
- ***Step 4***
  Calculate the member slenderness and reduction factors separately for pure minor axis flexural buckling and pure lateral-torsional buckling ($\bar{\lambda}$, χ, $\bar{\lambda}_{LT}$ and χ_{LT}
- ***Step 5***
  Calculate the interaction factors connecting the two pure buckling cases (Annex A or Annex B)
- ***Step 6***
  Calculate the design buckling resistance of the member and check the member combination of axial load and bending according to expressions 6.61 and 6.62

In Table 2 the above steps are summarized using the expressions and nomenclature of the conventional isolated member approach. The second column indicates the equivalent approach according to the general method.

In Figure 1 the meaning of the load amplifiers of ***Step 2*** and ***Step 3*** is illustrated. It is important to note that one cross section resistance, one elastic critical load factor and accordingly one slenderness and one reduction factor are determined. This makes the evaluation procedure simple, even though complex loading and buckling behaviour have been assessed. The accurate calculation of the factors used in the general method usually requires more refined analysis methods or specific software tools. In the next article the practical application of the general method will be covered, demonstrating that the general method offers opportunities for an efficient design procedure.

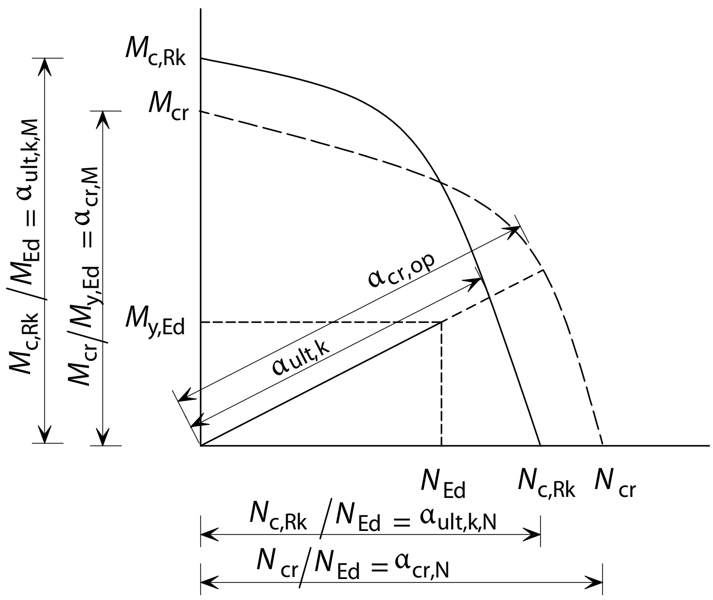


Figure 1: Load amplifiers for the conventional and the general methods

Outstanding Buildings in Steel

Recently completed buildings from Building with Steel, February 1961

Above: The new BBC Television Centre at Wood Lane. Standing on a 13 acre site this is the largest television headquarters in Europe.

Left: The new John Lewis store, an impressive example of steel-framed construction on a corner site at Oxford Street, London.

Right: New branch store at Ilford, Essex, for C & A Modes Ltd.

Bottom Left: Completed in September 1960, this new steel-framed building for the English Electric Co. Ltd., is on the site of the old Gaiety Theatre, Aldwych, London.

Below: New shop building for Messrs, Tyrell and Green Ltd, at Southampton.

BCSA mission to Japan

Reported by Frank Glover CEng FIStructE

In terms of output the British Structural Steelwork Industry is the European leader. However, on an international scale it is sobering to note that Japan, with only twice the population of the United Kingdom, produced ten times the amount produced by the UK in 1990. As an economic power Japan has undergone astonishing growth in the last few decades which has been witnessed by Western eyes with a mixture of admiration and fear. It is hardly surprising that the visit to Japan by BCSA members was keenly supported. The group consisted of thirty people representing eighteen fabricators and three steel suppliers.

We received advance briefing on what we were likely to see, but we left for Japan with an open mind and a brief to tour fabrication facilities. The time we were given for the tour was comparatively brief, the entire visit being effectively four days. In that time we visited three fabricators, two sites, a CAD/CAM centre; and had meetings at the Kozai Club and the Japan Steel-Rib Fabricators Association plus meetings with the British Embassy staff.

At our first briefing on our arrival we quickly learned that there was a need to appreciate the economical and political background to the Japanese business life, which appears to be a fully integrated national plan. We were encouraged to hear that the Japanese have a healthy respect for UK fabricators as witnessed by them when they visited some of the London sites early in 1990. Our flair for producing architectural steelwork is an attribute admired by the Japanese.

Fabrication

Our visits to the three fabricators showed work in progress at a very high level. Order books are full for at least nine months up to two years. The lead time from release of **all** details to delivery to site is approximately five months with the likelihood of variations being almost nil.

As a generality the fabrication equipment was similar to the UK but with widespread use of bandsaws and coping machines. Assembly work is carried out by the fabricator as far as possible, this being an international policy decided by the main contractor who, in turn, has responsibility for erection. Assemblies were repetitive with a common adoption of "Christmas Tree" assemblies with stub beams shopwelded onto the columns, which were predominantly box sections.

Each work station was stockpiled and laid out in the fashion of a standard production line. The planning of the flow of materials and work areas must have been very detailed, and further study of this aspect of planning would be beneficial. Coping and preparation machines were used as a matter of course, the use being justified by the quantity and standardisation of design/detail, and the shortage of labour.

Materials handling is also a technique worthy of further study. The use of rollerball beds was simple and effective and one had to marvel at the vast movement/stockpiling of pieces within the factories. It must be said that the party were far less impressed with the stockyard and dispatch areas. We also saw some beam lengths being drilled prior to sawing which again prompts further study.

Design and Standardisation

At first glance Japanese design seems heavy but it is not possible to analyse its merit without further knowledge of restraints of design such as safety, earthquakes and so on.

The standard nature of Japanese steel construction was a constant topic of discussion during our visit, and subsequently we have been provided with volumes of Japanese standard connections, example of which we saw repeatedly during our visit.

We were informed that Japanese consultants sometimes show reluctance to accept standard details and prefer to adopt their own details. We suspect this is the exception rather than the rule, and it can be appreciated that certain configurations may be of necessity be non-standard. Unquestionably the Kozai Club and the JSFA have made great efforts to rationalise connections as witnessed by the two excellent volumes of 'Standard Connection of Steel Structures' which contain not just tables, but also clear illustrations and photographs of appropriate standards of fabrication. These volumes compare more than favourably to the alternative and more customary specification which is usually illustrated text printed in small type, requiring a barrister to interpret same!

It is significant that Japanese fittings are bought in ready made in standard batches of steel or castings. The Japanese seem to buy these as commonly as we buy bolts.

The design and shop detail drawings are provided by the consultant and demonstrate the immense advantages of reasonable standardisation programmes and a reduction in variations. If variations do occur, then the effect is more clearly identified and measurable.

Erection

The 'Manhattan' hotel site was a source of envy amongst our contingent. The site pervaded an air of quiet efficiency which we felt was the direct result of detailed preplanning. We also felt that the standard methods of design and the resulting repetition was a major factor in aiding the high degree of planning.

Clearly the main contractor, who is himself responsible for the erection, has intentionally kept the work on site to an absolute minimum - even to the extent of arranging for the fabricator to carry out site welding and final bolting up.

From observations of the UK contingent the rate of erection was not dissimilar to that of the UK. However, this assessment would require further analysis taking into account the overall programme of activities, some of which would be carried out by the erection gang as part of the Main Contractor's team.

We were impressed by the very minimal work required to be done by the erection gang, and by the safety measures provided.

It was obvious that the provision of temporary fittings and erection aids had been well thought out and that no attempt whatsoever had been made to produce cosmetically finished appearances when the fittings were removed. To our eyes the finished appearances of, for instance, the column butt welds were unsightly, but we were assured that the welds had been proved by the test.

We had been previously advised that the Japanese maxim for standards of fabrication and erection was 'fitness for purpose'. This proved to be exactly the case. Simplicity with cost effectiveness was very apparent. It was noted that the general arrangement drawings contained details of the connections (rather than full members) which must have been extremely useful to refer to on site.

Commercial

"Trust" was a word used over and over again by our hosts and clearly, the preponderance of a UK form of contract was of indeed a foreign language to the Japanese.

Contractural considerations were hardly a factor. To quote one of our members: "Because of trust and co-operation, there was a distinct lack of contractual involvement in their industry. The UK industry would greatly benefit from a reduction in the line of dependence on constant reference to 'The Contract' which is a great waste of our skilled managers' ability and time."

Price levels in Japan were stable to the extreme. The last increase in steel price was in 1982. Contract prices were negotiated and trading houses were a central source of negotiation. The role of the trading house was explained to us using a range of products from noodles to aircraft!

Communication

At every stage of a project a strong 'face-to-face' link existed. The enquiry allowed realistic programming enabling everyone to work enthusiastically and happily to a common purpose. A strong sense of leadership was present, everyone having faith in and knowledge of the project.

The Japanese 'toolbox' meetings are well known. These must have merit if →

Taken from STEEL CONSTRUCTION, February 1991

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PURLINS · CLADDING RAILS · EAVES BEAMS · CHANNEL SECTIONS one considers the alternative which often is a trail of queries to the office of the supervisor/manager/main contractor, etc.

Computer aided manufacturing

Japan is regarded as world centre of computer hardware, so it was perhaps surprising to gain an impression that their software production is not correspondingly in step. The Japanese to whom we spoke informed us that their Management Information Systems were generally not yet computerised. We were also surprised to note that CAD/CAM systems were not yet fully integrated, particularly in view of the standard nature of their fabrication.

However, signs of investment are unmistakable with the growth of software houses (such as the CAD/CAM centre we visited) and the current installation of welding robots. It was tantalising to have a view of uncommissioned welding robots which led us to believe that software development is gathering pace.

Co-operation or Competition?

The visit showed us most clearly the continuing concerted efforts being made in Japan to constantly improve its industry. Investment in plant and buildings is most apparent and one had a feeling on continued change. The use of small companies was no ignored and, indeed, appears to be a vital part of the Japanese industrial scene.

We must therefore ask similar questions of ourselves in the UK. We concluded that is incorrect to view Japanese industry as being 'featherbedded' and it is incorrect to dismiss the attitude of the Japanese worker as being due to 'culture' (whatever that might mean). Attitudes clearly can be affected by leadership and recent history as described in this report shows the lead taken by the industrial sector at Government level and by the trade leaders and the companies themselves.

Clearly, in the UK we have for a very long time developed within individual organisations various information and operational systems, but these have been generally devoid of national/international involvement. The adoption, for instance, of standard details is universally agreed to be a vital ingredient for optimum production. The Japanese are well aware of this need and have already made great strides in this direction and continue to address the task with praiseworthy vigour.

In the UK and across Europe, efforts are similarly afoot within the 'EUREKA Cimsteel' project which presents an ideas opportunity to mirror the efforts of the Japanese. The EUREKA project will require the very same vigour shown in Japan if we hope to harmonise the conception, the plan, the implementation and the control of our manufacturing processes. If, however, we choose not to 'sing out of the same hymnbook' we must face the inevitability that our industry will contract and the gigantic structural steelwork industry in Japan will once again lead the march of industrial progress with the same determination recent history has shown us they are so capable of.

Conclusion

We have much to learn from Japan and it was encouraging to us during our visit to realise they equally can learn from us. The UK structural steelwork industry is much respected by the Japanese and their interest in us is very keen.

Co-operation or competition? In seeking an answer to this question from the Japanese, they appear to prefer the former as a better option. Their desire to impress and make friends of us was most apparent and we left Japan with a sense of optimism.

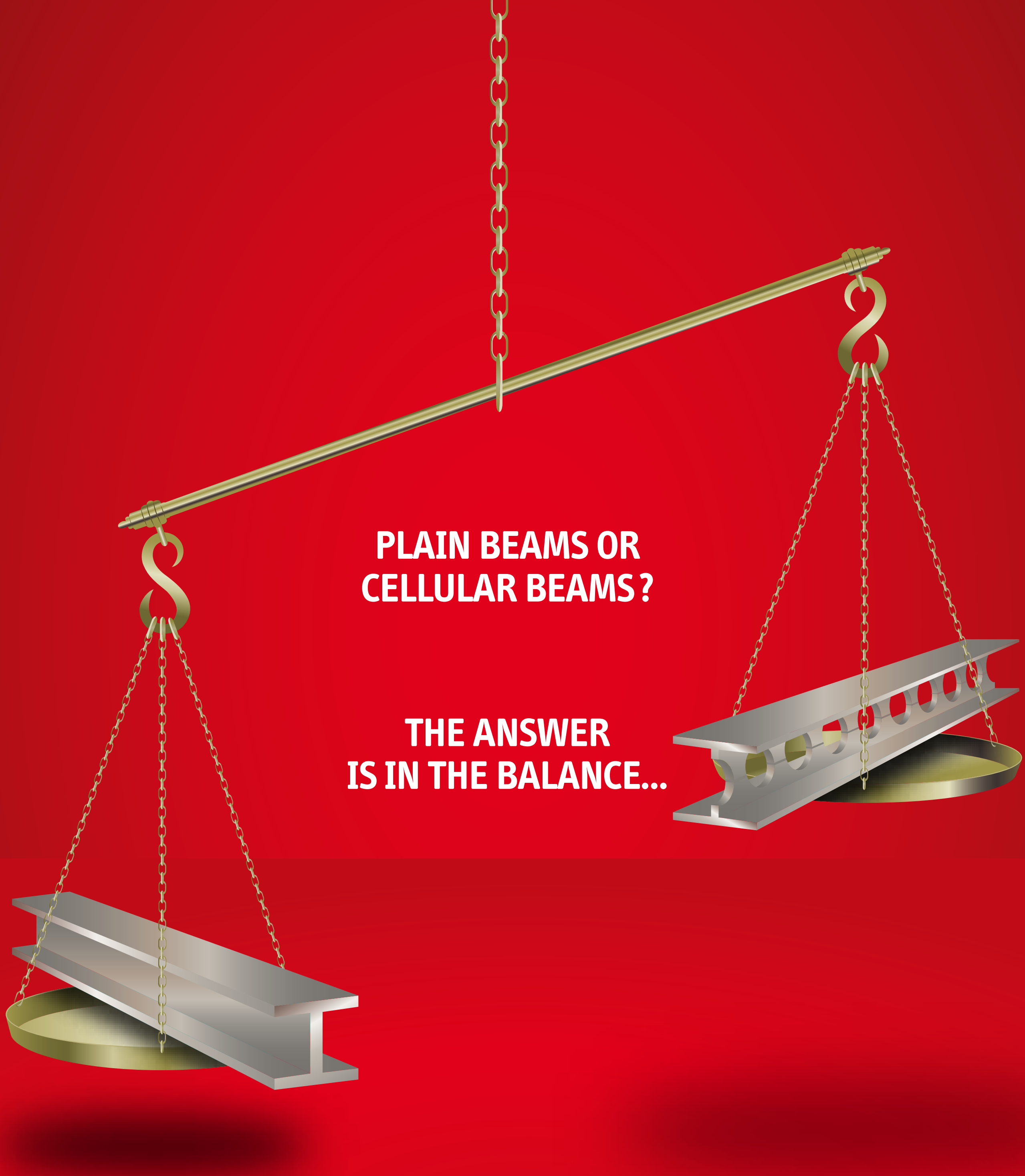
The 'miracle' growth of Japanese industry was undertaken by an environment of the need for national survival, strong direction, opportunism and (some say) good fortune. But, whatever the environment, the common factor is determination and the will to succeed.

The common thread within UK industry is less easy to identify. Conformity is perhaps less characteristic here in the UK but the strength of united progress has never failed to emerge in times of crisis. Nevertheless, the question remains – do we have to wait for a crisis? Improvements within our industry, as with any change, are best brought about by a steady and constant process, rather than spasmodic emergency-driven bursts of attention. The adoption of the EUREKA Cimsteel project is a major step in the right direction, providing as it does an opportunity for industry and Government to have a concerted approach.

The mission has seen the benefits gained in Japan by the successful operation of a non-cyclic economy. Uncertainties are therefore minimised and the progress in the industry is determined by a firm and dedicated policy by the whole of the country from its leaders to its workers.

In looking forward it is always advisable to also look sideways and missions such as this serve to highlight the choice we have to make. Do we continue to fear and envy our competition, whether these by other countries or other materials, or should we determine to improve our industry by a natural desire for co-operation and corporate involvement?

The UK constructional steelwork industry has mush to be proud of and the members of the mission hope that, in bringing back our experiences, we have further stimulated our common purpose.


PLAIN BEAMS OR
CELLULAR BEAMS?
THE ANSWER
IS IN THE BALANCE...

AD 357
Flexural buckling of Tees to EC3

Clause BB.1 in BS EN 1993-1-1:2005 covers "Flexural buckling of members in triangulated and lattice structures". Specific guidance is given for Angles as web members (BB.1.2) and for Hollow sections as chord & web members (BB.1.3).

Although there is no specific guidance for flexural buckling of Tee sections, this Advisory desk note outlines two reasonable approaches.

The first is based on the criteria given in clause BB.1.1. of BS EN 1993-1-1.

For Tees used as chords and connected through the flange or stem: In plane and out-of-plane buckling lengths can be taken as the system length unless a smaller value can be justified by analysis (BB.1.1 (1)B).

For Tees used as web members connected through the flange or stem: The out-of-plane buckling length can be taken as the system length unless a smaller value can be justified by analysis (BB.1.1 (1)B).

For Tees used as web members connected through flange or stem: The in-plane buckling length can be taken as 0.9 times the system length, provided there are at least 2 bolts at each end (BB.1.1 (3)B, (4)B) or the member is connected by welding.

Alternatively the following approach may be adopted, based on the principles of BS 5950-1:2000 (AMD 2007).

For a Tee section connected through its flange the slenderness may be calculated in accordance with clause 4.7.10.5.

For a Tee section connected through its stem the slenderness may be calculated in accordance with clause 4.7.10.3(c), (e), assuming $\lambda_c = 0$.

Contact: **Abdul Malik**
Tel: **01344 636525**
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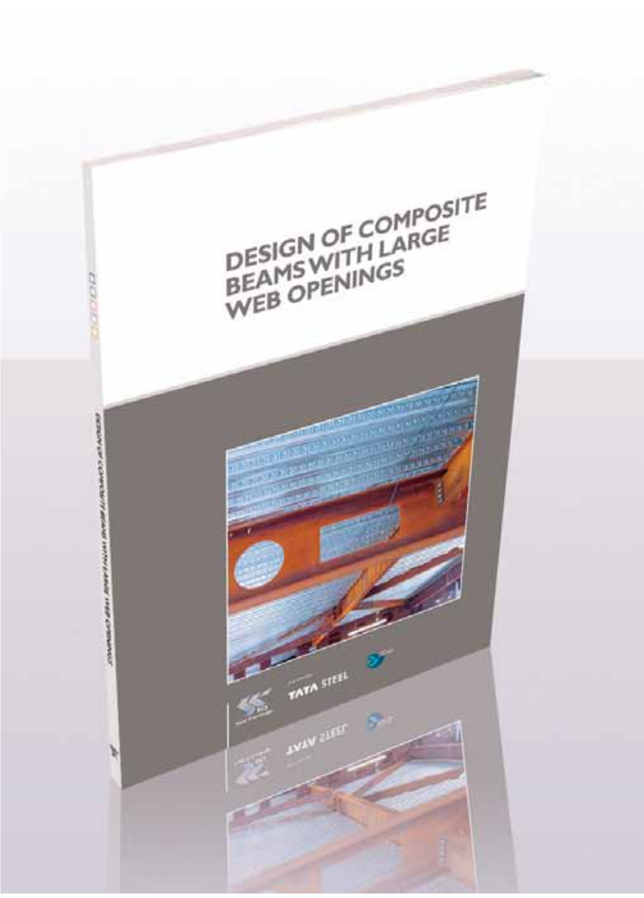
Publications

Design of Composite Beams with Large Web Openings



Composite floor beams are a preferred solution for multi-storey construction this type of construction can achieve long spans and openings in the web of the steel section facilitating service integration within the structural zone. However the presence of large opening in the web raises additional design considerations.

This new design guide provides comprehensive coverage of the design of a full range of fabricated and rolled beams with isolated and regularly spaced circular or rectangular web openings. The guide also covers the design of asymmetric steel sections, elongated round openings, stiffened openings and notched beams.

Design guidance has been prepared in a way that compliments design to the Eurocodes and includes a full numerical worked example for a secondary beam with pairs of rectangular and circular openings illustrating the use of the guidance.

Full Price £70.00
(BCSA and SCI member price £35.00)

Catalogue number	**P355**
ISBN number	978-1-85942-197-0
Authors	R M Lawson BSc (Eng) PhD CEng MICE MIStructE MASCE ACGI S J Hicks BEng PhD (Cantab.)
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New and revised codes & standards

From BSI Update March 2011

BS EN PUBLICATIONS

BS EN ISO 11666:2010
Non-destructive testing of welds. Ultrasonic testing. Acceptance levels
Supersedes BS EN 1712:1997

BS EN ISO 17640:2010
Non-destructive testing of welds. Ultrasonic testing. Techniques, testing levels, and assessment
Supersedes BS EN 1714:1998

BS IMPLEMENTATIONS

BS ISO 4998:2011
Continuous hot-dip zinc-coated carbon steel sheet of structural quality
Supersedes BS ISO 4998:2005

BS ISO 10302-1:2011
Acoustics. Measurement of airborne noise emitted and structure-borne vibration induced by small air-moving devices. Airborne noise measurement
Supersedes BS 848-2.6:2000

PD 6705-2:2010
Structural use of steel and aluminium. Recommendations for the execution of steel bridges to BS EN 1090-2
No current standard is superseded

CORRIGENDA TO BRITISH STANDARDS

BS EN 1993-4-1:2007
Eurocode 3. Design of steel structures. Silos
CORRIGENDUM 2. *Also incorporates Corrigendum 1*

BS EN 1998-1:2004
Eurocode 8. Design of structures for earthquake resistance. General rules, seismic actions and rules for buildings
CORRIGENDUM 2. *Also incorporates Corrigendum 1*

UPDATED BRITISH STANDARDS

BS EN 1991-1-4:2005+A1:2010
Eurocode 1. Actions on structures. General actions. Wind actions
AMENDMENT 1. *Also incorporates Corrigenda 1& 2*

NA to BS EN 1991-1-4:2005+A1:2010
UK National Annex to Eurocode 1. Actions on structures. General actions. Wind actions
AMENDMENT 1

BRITISH STANDARDS WITHDRAWN

BS EN 1712:1997
Non-destructive examination of welds. Ultrasonic examination of welded joints. Acceptance levels
Superseded by BS EN ISO 11666:2010

BS EN 1714:1998
Non-destructive testing of welded joints. Ultrasonic testing of welded joints
Superseded by BS EN ISO 17640:2010

NEW WORK STARTED

EN 1090-1:2009/A1
Execution of steel structures and aluminium structures. Requirements for conformity assessment of structural components

EN ISO 3059
Non-destructive testing. Penetrant testing and magnetic particle testing. Viewing conditions
Will supersede BS EN ISO 3059:2001

EN ISO 3452-1
Non-destructive testing. Penetrant testing. General principles

ISO 9712
Non-destructive testing. Qualification and certification of personnel

Strength from Advisory Service

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

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

Richard Dixon, Manager, Structural Advisory Services, who heads up the network of Regional Technical Managers throughout the UK and Ireland said: "We have a team of experienced regional engineers who are on hand to offer design support and advice to designers, and to point them to the wide range of technical guidance and resources available to them and inform them in a practical way on key topics like EC3 and the sustainability of steel construction through in-house CPDs."

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Steelwork contractors for buildings

BCSA

BCSA is the national organisation for the steel construction industry.
Membership of BCSA is open to any Steelwork Contractor who has a fabrication facility within the United Kingdom or Republic of Ireland.
Details of BCSA membership and services can be obtained from
Gillian Mitchell MBE, Deputy Directory General, BCSA, 4 Whitehall Court, London SW1A 2ES
Tel: 020 7839 8566 Email: *gillian.mitchell@steelconstruction.org*

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

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

Notes

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

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

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	Contract Value (1)
A C Bacon Engineering Ltd	01953 850611			●	●		●										Up to £2,000,000
ACL Structures Ltd	01258 456051			●	●	●	●				●				●		Up to £2,000,000
Adey Steel Ltd	01509 556677				●	●	●	●		●	●			●	●		Up to £3,000,000
Adstone Construction Ltd	01905 794561			●	●	●											Up to £1,400,000
Advanced Fabrications Poyle Ltd	01753 531116				●		●	●	●	●	●				●	✓	Up to £400,000
Angle Ring Company Ltd	0121 557 7241												●				Up to £1,400,000
Apex Steel Structures Ltd	01268 660828				●		●			●	●						Up to £800,000
Arromax Structures Ltd	01623 747466	●		●	●	●	●	●	●		●	●					Up to £800,000
ASA Steel Structures Ltd	01782 566366			●	●	●	●			●	●			●	●		Up to £800,000*
ASD Westok Ltd	01924 264121												●				Up to £6,000,000
ASME Engineering Ltd	020 8966 7150				●					●	●			●	●	✓	Up to £1,400,000*
Atlas Ward Structures Ltd	01944 710421		●	●	●	●	●	●	●	●	●	●		●	●	✓	Above £6,000,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●		●							●			Up to £2,000,000
B&B Group Ltd	01942 676770	●		●	●	●	●	●		●	●	●		●		✓	Up to £1,400,000
B D Structures Ltd	01942 817770			●	●	●	●				●			●			Up to £1,400,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●				✓	Up to £1,400,000
Barnshaw Section Benders Ltd	01902 880848												●			✓	Up to £800,000
Barrett Steel Buildings Ltd	01274 266800			●	●	●	●									✓	Up to £6,000,000
Barretts of Aspley Ltd	01525 280136			●	●	●				●	●			●	●	✓	Up to £3,000,000
BHC Ltd	01555 840006	●	●	●	●	●	●							●			Above £6,000,000
Billington Structures Ltd	01226 340666		●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000
Border Steelwork Structures Ltd	01228 548744			●	●	●	●			●	●				●		Up to £3,000,000
Bourne Construction Engineering Ltd	01202 746666		●	●	●	●	●	●	●	●	●	●	●	●		✓	Above £6,000,000
Briton Fabricators Ltd	0115 963 2901	●		●	●	●	●	●	●	●	●			●	●	✓	Up to £3,000,000
Browne Structures Ltd	01283 212720				●			●							●		Up to £400,000
Cairnhill Structures Ltd	01236 449393				●	●	●	●		●	●			●	●	✓	Up to £2,000,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●	●	●	●	●		●	●	✓	Up to £6,000,000
Cleveland Bridge UK Ltd	01325 502277	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000
CMF Ltd	020 8844 0940				●		●	●		●	●				●		Up to £6,000,000
Cordell Group Ltd	01642 452406	●			●	●	●	●	●	●	●					✓	Up to £3,000,000
Coventry Construction Ltd	024 7646 4484			●	●	●	●		●	●	●			●	●		Up to £1,400,000
Crown Structural Engineering Ltd	01623 490555			●	●	●	●		●		●			●		✓	Up to £800,000
D H Structures Ltd	01785 246269				●						●						Up to £40,000
Discain Project Services Ltd	01604 787276				●					●	●				●	✓	Up to £1,400,000
Duggan Steel Ltd	00 353 29 70072		●	●	●	●	●	●			●					✓	Up to £6,000,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●	●	●	●	●	●		●		✓	Up to £6,000,000
EvadX Ltd	01745 336413			●	●	●	●	●	●	●	●	●				✓	Up to £3,000,000
Fisher Engineering Ltd	028 6638 8521		●	●	●	●	●	●	●	●	●	●				✓	Above £6,000,000
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●			●						Up to £3,000,000
GME Structures Ltd	01939 233023			●	●		●	●		●	●			●	●		Up to £400,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●			Up to £800,000
Graham Wood Structural Ltd	01903 755991		●	●	●	●	●	●	●	●	●	●		●			Up to £6,000,000
Grays Engineering (Contracts) Ltd	01375 372411				●			●		●	●				●		Up to £100,000
Gregg & Patterson (Engineers) Ltd	028 9061 8131			●	●	●	●	●				●				✓	Up to £3,000,000
H Young Structures Ltd	01953 601881			●	●	●	●	●			●						Up to £2,000,000
Had Fab Ltd	01875 611711								●		●				●	✓	Up to £2,000,000
Hambleton Steel Ltd	01748 810598		●	●	●	●	●	●				●		●		✓	Up to £6,000,000
Harry Marsh (Engineers) Ltd	0191 510 9797			●	●	●	●				●	●					Up to £2,000,000
Henry Smith (Constructional Engineers) Ltd	01606 592121			●	●	●	●	●									Up to £4,000,000
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●		Up to £4,000,000
Hills of Shoeburyness Ltd	01702 296321									●	●				●		Up to £1,400,000
Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	Contract Value (1)

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	Contract Value (1)
J Robertson & Co Ltd	01255 672855									●	●				●		Up to £200,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●					●		●			Up to £6,000,000*
Kiernan Structural Steel Ltd	00 353 43 334 1445			●	●	●	●	●	●	●	●	●		●	●	✓	Up to £4,000,000
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●						Up to £1,400,000
Lowe Engineering (Midland) Ltd	01889 563244									●	●			●	●	✓	Up to £400,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●				●	✓	Up to £3,000,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●		Up to £1,400,000
Mabey Bridge Ltd	01291 623801	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000
Maldon Marine Ltd	01621 859000				●			●	●	●					●		Up to £1,400,000
Mifflin Construction Ltd	01568 613311		●	●	●	●	●				●						Up to £3,000,000
Newbridge Engineering Ltd	01429 866722			●	●	●	●								●	✓	Up to £1,400,000
Nusteel Structures Ltd	01303 268112						●	●	●	●						✓	Up to £4,000,000
On Site Services (Gravesend) Ltd	01474 321552				●		●	●		●	●				●		Up to £200,000
Overdale Construction Services Ltd	01656 729229			●	●		●	●			●				●		Up to £400,000
Paddy Wall & Sons	00 353 51 420 515			●	●	●	●	●	●	●	●					✓	Up to £6,000,000
Painter Brothers Ltd	01432 374400								●		●				●	✓	Up to £6,000,000
Pencro Structural Engineering Ltd	028 9335 2886			●	●		●	●			●				●	✓	Up to £2,000,000
Peter Marshall (Fire Escapes) Ltd	0113 307 6730									●					●		Up to £1,400,000
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●		Up to £1,400,000
REIDsteel	01202 483333		●	●	●	●	●	●	●	●	●	●		●			Up to £6,000,000*
Rippin Ltd	01383 518610			●	●	●	●	●									Up to £1,400,000
Robinson Steel Structures	01332 574711		●	●	●	●	●		●	●	●	●		●	●	✓	Above £6,000,000
Rowecord Engineering Ltd	01633 250511	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✓	Above £6,000,000
Rowen Structures Ltd	01773 860086		●	●	●	●	●	●	●	●	●	●		●			Above £6,000,000*
RSL (South West) Ltd	01460 67373			●	●		●				●						Up to £1,400,000
S H Structures Ltd	01977 681931						●	●	●	●							Up to £2,000,000
Severfield-Reeve Structures Ltd	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✓	Above £6,000,000
Shipley Fabrications Ltd	01400 231115			●	●	●	●		●	●	●				●		Up to £200,000
SIAC Butlers Steel Ltd	00 353 57 862 3305		●	●	●	●	●	●	●		●	●				✓	Above £6,000,000
SIAC Tetbury Steel Ltd	01666 502792			●	●	●	●				●	●				✓	Up to £3,000,000
Snashall Steel Fabrications Co Ltd	01300 345588			●	●		●								●		Up to £1,400,000
South Durham Structures Ltd	01388 777350			●	●	●				●	●	●			●		Up to £1,400,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●				●	●			●		Up to £200,000
The AA Group Ltd	01695 50123			●	●	●	●			●	●	●		●	●		Up to £4,000,000
Traditional Structures Ltd	01922 414172		●	●	●	●	●	●	●		●	●		●		✓	Up to £4,000,000*
Tubecon	01226 345261						●	●	●	●				●	●	✓	Above £6,000,000*
W & H Steel & Roofing Systems Ltd	00 353 56 444 1855			●	●	●	●	●						●	●		Up to £4,000,000
W I G Engineering Ltd	01869 320515				●					●					●		Up to £400,000
Walter Watson Ltd	028 4377 8711			●	●	●	●	●				●				✓	Up to £6,000,000
Watson Steel Structures Ltd	01204 699999	●	●	●	●	●	●	●	●	●	●	●		●	●	✓	Above £6,000,000
Westbury Park Engineering Ltd	01373 825500	●			●		●	●	●	●	●				●	✓	Up to £800,000
William Haley Engineering Ltd	01278 760591			●	●	●			●	●	●					✓	Up to £2,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000
Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	Contract Value (1)

Corporate Members

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

Company name	Tel
Balfour Beatty Utility Solutions Ltd	01332 661491
Griffiths & Armour	0151 236 5656
Roger Pope Associates	01752 263636
Highways Agency	08457 504030

Associate Members

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

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

Company name	Tel	1	2	3	4	5	6	7	8	9
AceCad Software Ltd	01332 545800		●							
Albion Sections Ltd	0121 553 1877	●								
Andrews Fasteners Ltd	0113 246 9992									●
ArcelorMittal Distribution – Birkenhead	0151 647 4221								●	
ArcelorMittal Distribution – Birmingham	0121 561 6800								●	
ArcelorMittal Distribution – Bristol	01454 311442								●	
ArcelorMittal Distribution – Manchester	0161 703 9073								●	
ArcelorMittal Distribution – Mid Glamorgan	01443 812181								●	
ArcelorMittal Distribution – Scunthorpe	01724 810810								●	
ArcelorMittal Distribution – Wolverhampton	01902 365200								●	
Arro-Cad Ltd	01283 558206			●						
ASD Interpipe UK Ltd	0845 226 7007								●	
ASD metal services - Biddulph	01782 515152								●	
ASD metal services - Bodmin	01208 77066								●	
ASD metal services - Cardiff	029 2046 0622								●	
ASD metal services - Carlisle	01228 674766								●	
ASD metal services - Daventry	01327 876021								●	
ASD metal services - Durham	0191 492 2322								●	
ASD metal services - Edinburgh	0131 459 3200								●	
ASD metal services - Exeter	01395 233366								●	
ASD metal services - Grimsby	01472 353851								●	
ASD metal services - Hull	01482 633360								●	
ASD metal services - London	020 7476 0444								●	
ASD metal services - Norfolk	01553 761431								●	
ASD metal services - Stalbridge	01963 362646								●	
ASD metal services - Tividale	0121 520 1231								●	
Austin Trumanns Steel Ltd	0161 866 0266								●	
Ayrshire Metal Products (Daventry) Ltd	01327 300990	●								
BAPP Group Ltd	01226 383824									●
Barnshaw Plate Bending Centre Ltd	0161 320 9696	●								
Barrett Steel Ltd	01274 682281								●	
Cellbeam Ltd	01937 840600	●								
Cellshield Ltd	01937 840600							●		
CMC (UK) Ltd	029 2089 5260							●		

Steelwork contractors for bridgework

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

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

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

Notes

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

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

BCSA steelwork contractor member	Tel	FG	PG	TW	BA	CM	MB	RF	AS	QM	Contract Value [1]
B&B Bridges Ltd	01942 676770	●	●	●	●	●	●	●	●	✓	Up to £1,400,000
Briton Fabricators Ltd	0115 963 2901	●	●	●	●	●	●	●	●	✓	Up to £3,000,000
Cairnhill Structures Ltd	01236 449393	●	●		●			●	●	✓	Up to £2,000,000
Cleveland Bridge UK Ltd	01325 502277	●	●	●	●	●	●	●	●	✓	Above £6,000,000
Kiernan Structural Steel Ltd	00 353 43 334 1445	●	●	●	●			●	●	✓	Up to £800,000
Mabey Bridge Ltd	01291 623801	●	●	●	●	●	●	●	●	✓	Above £6,000,000
Nusteel Structures Ltd	01303 268112	●	●	●	●	●		●	●	✓	Up to £4,000,000
Painter Brothers Ltd	01432 374400	●		●					●	✓	Up to £6.000,000
Rowecord Engineering Ltd	01633 250511	●	●	●	●	●	●	●	●	✓	Above £6,000,000
SIAC Butlers Steel Ltd	00 353 57 862 3305	●	●	●	●	●		●	●	✓	Above £6,000,000
TEMA Engineering Ltd	029 2034 4556	●	●	●	●	●	●	●	●	✓	Up to £1,400,000*
Varley & Gulliver Ltd	0121 773 2441	●						●	●	✓	Up to £4,000,000
Watson Steel Structures Ltd	01204 699999	●	●	●	●	●	●	●	●	✓	Above £6,000,000
Non-BCSA member											
ABC Bridges Ltd	0845 0603222	●								✓	Up to £100,000
A G Brown Ltd	01592 630003	●						●	●	✓	Up to £800,000
Allerton Steel Ltd	01609 774471	●	●	●	●	●	●	●	●	✓	Up to £1,400,000
Carver Engineering Services Ltd	01302 751900	●	●	●	●		●	●	●	✓	Up to £2,000,000
Cimolai Spa	01223 350876	●	●	●	●	●	●			✓	Above £6,000,000
Concrete & Timber Services Ltd	01484 606416	●	●	●		●	●		●	✓	Up to £800,000
Donyal Engineering Ltd	01207 270909	●						●	●	✓	Up to £800,000
Four-Tees Engineers Ltd	01489 885899	●	●	●	●		●	●	●	✓	Up to £2,000,000
Francis & Lewis International Ltd	01452 722200							●	●	✓	Up to £2,000,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456	●	●	●	●	●		●	●	✓	Up to £6,000,000
Hollandia BV	00 31 180 540540	●	●	●	●	●	●	●	●	✓	Above £6,000,000
Interserve Project Services Ltd	0121 344 4888							●	●	✓	Above £6,000,000
Interserve Project Services Ltd	020 8311 5500	●	●	●	●		●	●	●	✓	Up to £800,000*
Millar Callaghan Engineering Services Ltd	01294 217711	●						●		✓	Up to £800,000
N Class Fabrication & Installation	01733 558989	●	●	●	●			●		✓	Up to £800,000
P C Richardson & Co (Middlesbrough) Ltd	01642 714791	●						●	●	✓	Up to £3,000,000*
The Lanarkshire Welding Company Ltd	01698 264271	●	●	●	●	●	●	●	●	✓	Up to £2,000,000

Company name	Tel	1	2	3	4	5	6	7	8	9
Composite Metal Flooring Ltd	01495 761080	●								
Composite Profiles UK Ltd	01202 659237	●								
Computer Services Consultants (UK) Ltd	0113 239 3000		●							
Cooper & Turner Ltd	0114 256 0057									●
Cutmaster Machines UK Ltd	01226 707865					●				
Daver Steels Ltd	0114 261 1999	●								
Development Design Detailing Services Ltd	01204 396606			●						
Easi-edge Ltd	01777 870901							●		
Fabsec Ltd	0845 094 2530	●								
FabTrol Systems UK Ltd	01274 590865		●							
Ficep (UK) Ltd	01924 223530					●				
FLI Structures	01452 722200	●								
Forward Protective Coatings Ltd	01623 748323						●			
Hadley Rolled Products Ltd	0121 555 1342	●								
Hempel UK Ltd	01633 874024						●			
Hi-Span Ltd	01953 603081	●								
Highland Metals Ltd	01343 548855						●			
Hilti (GB) Ltd	0800 886100									●
International Paint Ltd	0191 469 6111						●			
Jack Tighe Ltd	01302 880360						●			
Jamestown Cladding and Profiling	00 353 45 434288	●								
Kaltenbach Ltd	01234 213201					●				
Kingspan Structural Products	01944 712000	●								
Leighs Paints	01204 521771						●			
Lindapter International	01274 521444									●

Company name	Tel	1	2	3	4	5	6	7	8	9
Metsec plc	0121 601 6000	●								
MSW	0115 946 2316	●								
National Tube Stockholders Ltd	01845 577440								●	
Northern Steel Decking Ltd	01909 550054	●								
Panels & Profiles	0845 308 8330	●								
John Parker & Sons Ltd	01227 783200								●	●
Peddinghaus Corporation UK Ltd	01952 200377					●				
Peddinghaus Corporation UK Ltd	00 353 87 2577 884					●				
PMR Fixers	01335 347629	●								
PP Protube Ltd	01744 818992	●								
PPG Performance Coatings UK Ltd	01773 837300						●			
Prodeck-Fixing Ltd	01278 780586	●								
Rainham Steel Co Ltd	01708 522311								●	
Richard Lees Steel Decking Ltd	01335 300999	●								
Schöck Ltd	0845 241 3390	●								
Structural Metal Decks Ltd	01202 718898	●								
Studwelders Composite Floor Decks Ltd	01291 626048	●								
Tata Steel	01724 404040				●					
Tata Steel Distribution (UK & Ireland)	01902 484100								●	
Tata Steel Service Centres Ireland	028 9266 0747								●	
Tata Steel Service Centre Dublin	00 353 1 405 0300								●	
Tata Steel Tubes	01536 402121				●					
Tekla (UK) Ltd	0113 307 1200		●							
Tension Control Bolts Ltd	01948 667700									●
Wedge Group Galvanizing Ltd	01909 486384						●			

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