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NSC

NEW STEEL CONSTRUCTION

www.new-steel-construction.com

Olympic flagship stadium
Waste to energy plant
Fife hospital prescribes steel
Steel college for Sheffield

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

Cover Image
London 2012 Olympic Stadium
Main Client: Olympic Delivery Authority
Architect: Populous
Steelwork contractor: Watson Steel Structures
Steel tonnage: 10,000t

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Pain-free tendering

Procurement professionals always need all the help they can get in first of all making sure the right processes are in place and observed for letting contracts of all sizes, and in selecting contractors and other suppliers. At least making sure the right steelwork contractor is selected is made easy by the BCSA's assessment procedures for its members. All BCSA's steelwork contractor members and RQSC Bridgeworks Registered Steelwork Contractors have volunteered to undergo regular assessment, being visited by experienced auditors who ensure their capabilities are up to scratch.

Clients can rely on these assessments as an easy way to pre-qualify steelwork contractors for buildings and bridges before contracts are tendered. This delivers confidence that the contractor has the relevant specialist skills to deliver the project successfully, as well as giving clients reassurance that they have fulfilled their regulatory duty to use only competent contractors.

When assessing capabilities the auditors inspect contractors under two primary criteria, Class and Category. Class gives guidance on the size of steelwork contract that the contractor has both the financial and management resources to undertake. Annual turnover, net asset value and public liability insurance are taken into account and references are taken up.

The categories indicate what type of steelwork a contractor is competent to undertake, which takes account of its work facilities, track record and technical and management experience. For buildings there are 14 categories of work for which contractors are assessed for suitability to undertake. Deciding who can be judged suitable is no mere matter of ticking boxes on a list as the auditors carry out a rigorous inspection of suitability on their assessment visits.

The Highways Agency values the bridges assessments so highly that only contractors listed on the BCSA's scheme can be employed in the fabrication and erection of bridges.

Procurement professionals have other reasons to value the BCSA schemes. It makes it easy to check the quality credentials of the registered companies.

More pressingly even than normally, clients have also to ensure that they are achieving the best price for the services they procure – with over 120 BCSA member companies a competitive price is ensured. Using the BCSA list to match companies to tender opportunities removes the danger of using a company that might submit an unsustainably low price, so clients can be confident that the contractor can finish the job it starts.

Steelwork contractors can be sourced according to the required project class and category at www.steelconstruction.org

Nick Barrett - Editor

Revision of Approved Document A delayed

The Department for Communities and Local Government (DCLG) has decided to postpone the revision of Approved Document A until 2013 on the grounds that it needs to take into account the latest UK climate change projections.

"This means the current version of Approved Document A will remain in force until 2013, but more importantly National Standards will continue to be referenced in it as acceptable methods of satisfying Building Regulations," said Dr David Moore, BCSA Director of Engineering.

The BCSA will carry on working to ensure that National Standards continue to be referenced in the revised Approved Document A after 2013.

However, the situation is currently less clear in Scotland where ministers are considering removing British Standards and including a reference to Eurocodes from next year.

Steel tops Elephant and Castle tower

Steelwork for the uppermost sections of Brookfield's 43-storey Strata SE1 tower in London's Elephant & Castle has been completed.

The privately funded project will be the capital's tallest private residential building and consists of 408 apartments, with the first 10 floors given over entirely to shared equity housing.

Topping the building will be three wind turbines, each with a maximum output of 15kW, designed to power the structure's common areas. The turbines will be housed within the steel structure which gives the building a distinctive angled roof.

The roof structure is 17m high and the front is formed by four elliptical shaped CHS sections, while the rear has six circular openings.

Gyan Aryaratna, Bourne Steel Contracts Manager, said: "The curved members are joined with 66 beams which form the surface for the cladding. To accept this cladding, there are hundreds of brackets welded to the steel structure all of which are unique because of the shape."

Working on behalf of main contractor Brookfield Construction, Bourne completed its steelwork programme in three and a half weeks. "Erecting 150m above the ground was a challenge as all steelwork had to be lifted up piece-small," said Mr Aryaratna. "The largest steel element lifted to the roof was a 7.5t beam which forms a rooftop canopy over a window cleaning crane."

To make sure the steel programme went to plan, Bourne trial erected the entire roof structure before dismantling it and transporting it to site in erectable pieces.

Rebirth of Ravenscraig continues with sports facility

The steel frame for the £31M Ravenscraig Regional Sports Facility is nearing completion on the former steelworks site in North Lanarkshire.

The indoor centre will include an artificial football pitch, a sports hall, gymnasium and an athletics hall, while outside there will be a further artificial pitch and six 5-a-side football pitches.

Steelwork for the structure has been designed by Buro Happold, while erection is being undertaken by Bone Steel. The steelwork includes some large trusses which span 72m over the football hall. The trusses are constructed from rolled column and angle sections to form an economical structure, and have bolted connections for ease of site assembly.

The facility was designed by Populous, and has been made possible by funding from North Lanarkshire Council and Ravenscraig Limited with an additional £7.3M backing by the Scottish Government, through the national sports agency sportscotland.

EU restarts amending CPD

The European Union has restarted the process of amending the Construction Products Directive (CPD) and will meet to get a final agreed position by November 2009.

Once an agreed position has been reached the second reading of the CPD will start. This is expected to begin in December, with a three month duration which can be extended by a further month. A final agreed CPD would then be complete in spring 2010.

The main amendment to the Directive is that it is likely to change to a Regulation. CE Marking is optional under a Directive, but under a European Regulation it will be mandatory in all member states including the UK and the Republic of Ireland.

If accepted the effect will be that CE Marking of fabricated steelwork will become mandatory in early 2012.

Production efficiency doubled with plate processor

One of Kaltenbach's latest plate processing centres, a KF1606 single head CNC plasma system, has been installed at the purpose built site of a Scottish steelwork contractor.

The KF1606 has been developed specifically for the demands of fabricators and stockists, as accurate profiles and drilled, counter-bored and tapped holes can be rapidly achieved in strip-fed material from 6mm to 60mm thick.

Fully PLC controlled via a user-friendly, integrated monitor and keyboard console, the speed and accuracy of the KF1606 is supported by a precision, material feed and length positioning twin-gripper system on an 8m long input rollerway.

Cutting torch head and tool-bits are PLC traversed and positioned to suit, with tool-bit speed and feed rates automatically pre-programmed via the machines operating system to suit each selected tool diameter. Operator override is also possible via the control panel.

Bridging Reading's new gateway

Two new steel composite bridges have been lifted into place as part of the improvement scheme at the M4's busy Junction 11.

Expected to be complete during the summer of 2010, the project's two new four lane bridges have been erected around the outside of the existing junction. These new structures will carry the bulk of the traffic, while the existing bridges will be converted to priority routes for public transport, pedestrians and cyclists.

Both steel composite bridges are 41m long and were fabricated and then delivered to site in three sections. These sections consisted of a pair of braced girders, complete with all crossmember beams.

The new eastern bridge was lifted into place during a night time closure of the M4 at the end of July, while the western structure was erected during a similar procedure in August.

"For both bridge lifts three large pairs of girders were individually delivered to site from our yard in Chepstow, which was quite straightforward as it's just along the M4," says Mark Simon, Project Manager for steelwork contractor Fairfield-Mabey. "Once delivered the pairs of girders were then lifted into place by a 500t capacity mobile crane.

AROUND THE PRESS

Construction News
3 September 2009
True as steel
Weighing up the odds, NPS finally opted for steel (for Bideford College). "Steel is quite easily recyclable, unlike Glulam, where you have to literally shred it up and burn it," says NPS designer Steven Western.

Contract Journal
26 August 2009
All change at Cheapside
Steel columns have been connected to the top of the plunge columns which effectively means the project's steel skeleton extends from the roof top to below ground level.

New Civil Engineer
3 September 2009
Steeling the show
(M74 extension) Lifting these huge steel girders into place required months of planning and one of the UK's largest mobile cranes.

New Civil Engineer
3 September 2009
Waste not want not
(Riverside energy plant) Most of the main frame of the building is structural steelwork. This will eventually include more than 2,000t of steel, with a similar amount of steelwork being installed by another subcontractor, for internal supports and walkways.

Contract Journal
2 September 2009
London's pink elephant is turning green
The complex geometry of the roof at Castle House means that Bourne Steel constructed a 17m-high frame with four curves and six elliptical shaped curves made out of circular hollow steel sections.

Invaluable advice for steel construction

A new pocket-sized guide offering helpful advice and useful reference across a number of steel construction topics has been jointly published by the BCSA and Corus and is available free with this issue of *New Steel Construction*.

Known as *Steel Essentials*, the guide is also complemented by a website - *www.steelessentials.info* - which includes links to reference works as well as sources of further information and a downloadable version of the guide.

Steel Essentials contains 12 chapters covering Health & Safety; Economics & Programme; Sustainability; Structural Design; Connections; Fire Protection & Engineering; Acoustic Performance; Corrosion Protection; Product Information; Codes & Standards; Fabrication & Erection, and Project Specifications.

Stockholder increases efficiency with bespoke machine

John Parker & Sons has installed a fully automated FICEP 601DZB drilling and sawing system for the processing of sections. This is the first FICEP unit in the UK to have a fully automatic beam rotating device which allows sections to be drilled and sawn in the 'I' position.

This function has been specifically designed for John Parker and is said to be particularly advantageous for profiled sections that need to be drilled while standing up.

John Goring, Commercial Manager of John Parker, said: "We purchased a range of FICEP machines as they are technically advanced. They have enabled us to develop custom software to download NC files direct into our system to create an enquiry."

Mr Goring added that the company is now able to offer a comprehensive steel processing facility. Processes available include drilling, laser, profiling as well as shearing and plasma cutting.

Olympic media centre takes shape

The 4,500t steel frame for the London 2012 International Broadcast Centre (IBC) has been completed in ten weeks.

The IBC, combined with the Main Press Centre, will support around 20,000 broadcasters, photographers and journalists, while in legacy the facilities will be converted into business space

The frame of the IBC, fabricated and erected by Severfield-Reeve, is 275m-long, 104m wide, 21m high and is said to be big enough to house five jumbo jets. During the Games the building will have 52,000m^2 of studio space and 8,000m^2 of offices.

Tessa Jowell, Minister for the Olympics, said: "The IBC's giant steel frame is a perfect example of how the Games are benefitting the whole of the UK with businesses in Yorkshire and the North East involved in its development."

Wimbledon's retractable roof scoops European design accolade

The redevelopment of Wimbledon's Centre Court, which included the construction of a retractable roof, was awarded a European Steel Design Award at an international ceremony in Barcelona on 17 September.

The awards are given by the European Convention for Constructional Steelwork (ECCS) every two years to encourage the creative and outstanding use of steel in architecture and construction.

Wimbledon's retractable steel roof (which also won an SSDA this year) weighs 1,100t, with its air conditioning plant adding a further 400t. This meant the roof's four main trusses spanning 77m between columns had to be very substantial in terms of strength and stiffness.

The roof is divided into two sections with four bays in one and five in the other. When the roof is deployed each section is extended over the court and they join in an overlapping concertina seam over the centre of the court. At the same time fabric is unfolded by hinged arms in four lines on top of each truss. Operated by electro mechanical actuators, they help to push and keep the trusses apart.

Deploying the roof over the court will take under 30 minutes, keeping disruption to the Centre Court action to a minimum.

The project team included architect Populous, structural designer Capita Symonds, steelwork contractor Watson Steel Structures and main contractor Galliford Try.

World class academy for Manchester

The steel frame for the new state of the art Manchester Enterprise Academy has been completed by Billington Structures.

The £19M educational facility will provide 750 places for 11 to 16 year-olds as well as post-16 eduction for 120 students when it opens in 2010.

Mick Strutt, Project Manager for steelwork contractor Billington Structures, said: "The completion of this steel project enhances our strong reputation within the construction and education sectors."

The academy is situated in Wythenshawe, south Manchester on the site of the existing Parklands High School. The academy is currently utilising the existing school buildings before moving into its own purpose built facilities next September.

Main contractor for the project is Balfour Beatty Construction.

New home for historic Bodleian Library

Millions of books from Oxford University's historic Bodleian Library are to be housed in a new steel framed storage facility in Swindon.

A ground breaking ceremony was held in September and construction is now well under way on the 15-acre plot. Working on behalf of main contractor Mace Plus, Atlas Ward Structures is responsible for the fabrication and erection of 750t of structural steelwork for the building which will measure approximately 37,490m^2.

The proposed new storage facility, which will have a capacity of approximately 8M volumes, symbolises the University's commitment to the access and preservation of the printed book. It will provide essential space and better conditions to store a proportion of the Bodleian's print collections for current and future generations of readers, thereby honouring Bodley's legacy.

The new facility is due for completion in September 2010.

NEWS IN BRIEF

The **BCSA** together with the **Highways Agency** has formed a working group to develop a National Highways Sector Scheme for mechanical fasteners. The aim is to develop a national sector integrated management scheme within an ISO 9001 framework.

Andrews Fasteners' partnering factory in Malaysia now has BS EN ISO 9001:2008 Quality System; BS EN 15048 Part One: 2007 Non Preload CE Approval; and BS EN 14399 Part One: 2005 Pre Load CE Approval.

The **BCSA** is developing a bolt competency course for those involved in the installation of bolts, with a pilot course to be held in October. Initially the course will focus on bridges but may be extended to buildings.

The Steel Sector Sustainability Strategy will be launched at a special 'free of charge' event at the Cavendish Conference Centre in London on Wednesday 28 October. To register your place online visit *www.corusevents.com* or email your full details to *events@ corusgroup.com*

Preeti Mistry, a student at **Imperial College** has recently completed an MSc thesis on the 'Assessment of Welding Standards'. The aim of the study was to identify the welding standard and specifications required for buildings with the introduction of CE Marking and to highlight the benefits and implications for designers and steelwork contractors. The study found that for a steelwork contractor to CE Mark its products it is required to have in place a Factory Production Control (FPC) system (to BS EN 1090-1), a Welding Quality Management System (to the relevant part of BS EN ISO 3834) and a competent and qualified Responsible Welding Coordinator (RWC).

Bluebirds kick off season in new home

Championship side Cardiff City (the Bluebirds) started the current football season in a new 26,800 all-seater stadium.

Completed this summer by a project team which included Laing O'Rourke, Arup and steelwork contractor Rowecord Engineering, the stadium is only a stone's throw from the club's previous home Ninian Park.

Rowecord was responsible for erecting 3,500t of structural steelwork as well as installing concrete terracing and all metal decking.

All steelwork was erected by a mobile crane positioned on the pitch. Once the terracing for the four stands had been completed, with the exception of the front 17 rows of seats which were left out to allow better crane access, Rowecord then erected the steel roof.

The roof is a constant disc that wraps around the entire stadium. It cantilevers out by 28m and is predominantly formed with CHS members. It is held up by two columns per grid, one of which penetrates the roof and forms a mast and is then tied back to the roof via stays.

Raising the floor for Tesco car park

Occupying most of a 9.5 acre site in Chesterfield, Derbyshire, steelwork for a new Tesco Extra has recently been completed by Caunton Engineering.

On the site of the former Dema Glass factory, the erection of the structure benefited from Caunton's accelerated site programme, jointly developed with main contractor Bowmer & Kirkland. The store is scheduled to open by the end of the year.

More than 1,800t of structural steelwork was fabricated, supplied and erected for the project by Caunton. The large portal framed structure has been designed to incorporate a 995 space car park at ground floor level.

The project forms part of a much larger regeneration scheme covering a 22 acre site purchased by developer Wilson Bowden. A new stadium for local football club Chesterfield is planned and should be ready for the beginning of the 2010/11 season.

Diary

For all Corus events visit www.corusevents.com tel: 01724 405060 email events@corusgroup.com
For all SCI events contact Jane Burrell tel: 01344 636500 email: education@steel-sci.com

6 October 2009
Steel Building Design to EC3
Glasgow

8 October 2009
SCI Members Day
Ascot

13 October 2009
Steel Building Design to EC3
Dublin

20 October 2009
Light Gauge Steel Design
Derby

28 October 2009
Steel Sector Sustainability
Seminar
Cavendish Conference Centre, London
Free

4 November 2009
ISE Steel Frames & Disproportionate Collapse Rules
Joint with ISE / London

10 November 2009
Portal Frame Design
Sheffield

11 & 12 November 2009
Essential Steelwork Design (2 Day)
Newcastle

19 November 2009
Steel Frames & Disproportionate Collapse Rules
Edinburgh

25 November 2009
ISE Preparation for Eurocodes
Joint with ISE/London

1 December 2009
Floor Vibrations in Steel Framed Structures
Joint with ISE/London

1 December 2009
Stability of Steel Framed Buildings
Milton Keynes

8 & 9 December 2009
Essential Steelwork Design (2 Day)
Watford

A wing to suit programme constraints

Kirkcaldy's Victoria Hospital is in the midst of a redevelopment with the construction of a new wing. A steel frame has proven to be the answer for a project which has a tight construction programme and an existing hospital next door, reports Martin Cooper.

The rationalisation of healthcare services in Fife is currently under way with the construction of a new wing at Kirkcaldy's Victoria Hospital. Once complete the new building will significantly expand the Scottish town's main hospital and allow specialist services to be relocated from the nearby Forth Park Hospital which will close down.

Main contractor for the project is Balfour Beatty, working on its ninth major hospital scheme under the Government's PPP programme. As part of a 30 year concession, Consort, Balfour's specialist PPP healthcare company, will provide the new wing which includes 11 operating theatres, an emergency care centre, 13 wards, surgical and medical assessment units, a maternity unit, and a women and children's unit.

Offering a total floor area of 50,000m^2 over six levels, the wing will accommodate approximately 500 beds within a mixture of one-bed and four-bed rooms.

Unlike the existing 1960s Victoria Hospital buildings, which are dominated by a large austere rectangular tower block, architect BDP has designed a waveform structure which will also incorporate a landscaped area with public entrance and car park. This architecturally striking building is intended to present a bold statement as it will be the first part of the hospital many people will see upon arrival.

Although this new wing is an independent structure it will link into the older buildings at ground floor and basement levels. Where old and new buildings meet a new entrance area is being built adjacent to the existing access point for the hospital's A&E.

The steel framed wing is essentially two linear blocks joined at either end and in the middle to create two large central voids or lightwells. The western block features a waveform or undulating outer elevation, while the eastern block is more rectangular in shape.

Using a steel frame for the project was always on the cards for this project due to the tight

Above: By September more than half of the steel frame was complete
Top left: The southern tip of the new wing where the wave-form and rectangular blocks meet
Bottom left: The hospital is located adjacent to former warehouses in an area earmarked for further development

FACT FILE
Victoria Hospital, Kirkcaldy, Fife
Main client: *NHS Fife*
Architect: *BDP*
Main contractor: *Balfour Beatty*
Structural engineer: *WYG*
Steelwork contractor: *Severfield-Reeve Structures*
Steel tonnage: *3,700t*
Project value: *£170M*

construction programme. The client wants the job complete by 2012, and to this end Balfour Beatty will hand over the site to NHS Fife in November 2011 so it can then begin its own fit-out programme.

"Work on site began in late 2008 and consequently with such a tight timescale a steel frame was the best solution," explains Giles Smith, WYG's Project Engineer.

Roddy Mackay, Project Director for Balfour Beatty agrees and adds: "We have a successful track record for building hospitals in steel and a good working relationship with Severfield."

Vibration can sometimes be an issue on hospital construction, but all functional areas of the composite floors were assessed with the methods set out in the Steel Construction Institute (SCI) design guide.

"The floor directly above the operating theatres houses a plant area and here the floor slab is thicker by 30mm," explains Mr Mackay. "Likewise the roof area houses another plant area and again we've beefed up the composite floor."

The construction site, for what is the largest ongoing project in Fife, is obviously right next to the southern elevation of the existing hospital. Some of this land was previously owned by the NHS and the rest was owned by the nearby linoleum factory and used for warehousing.

The proximity of a 'live' healthcare facility has posed one of the biggest challenges for the project team. There was initially a bit of concern about the potential levels of noise generated by the site. But Balfour Beatty liaises fortnightly with the client to discuss topics such as noise and there have been no complaints from angry neighbours.

Some of the early works took place within feet of the existing buildings, and Mr Mackay says noise has not been a problem. "The steel erection is going well and it's generally less noisy than other construction methods. There is obviously some noise, but we've found it easy to keep it to minimum."

Steel erection began at the southern end of the new wing and has progressed in a northerly direction, with the final elements, adjacent to the existing building and forming the new entrance, due to be completed by the end of the year.

Working towards the existing hospital was the chosen method as it allowed Balfour Beatty to complete the modifications to the entrance area before the new steel frame was fully erected.

"Part of the existing entrance and one of the vehicle access ramps are on the footprint of the new wing," says Mr Mackay. "We had to demolish the ramp and put in temporary bridges, which was all done while the steel frame was under way at the other end."

Working in this direction was quite a convenient way to phase the project as the new wing is split in half by a movement joint which runs across the structure's width. "We initially erected one bay north of the movement joint and then worked towards the southern end of the structure," explains Steve Swift, Project Manager for Severfield-Reeve Structures.

Incidentally, while the steel fabrication is being done by Severfield-Reeve, the steel erection and supply and installation of metal decking is actually being undertaken by Fisher Engineering, a subsidiary of Severfield Rowen and sister company to Severfield-Reeve.

The structure is braced throughout for stability. However, during erection the frame has required temporary bracing to be inserted on all levels and then is only removed when the concrete decks have been cast two floors above.

"The steel erection is going well and it's generally less noisy than other construction methods"

Primarily the steelwork is erected around a 7.3m x 8.1m grid, but the shape of the building means this pattern has to vary on all levels. This is to accommodate the undulating wave-like eastern facade and the central lightwells which get wider from second floor level and above. By the upper levels each wing is approximately 18m wide.

An interesting element of the project is how something as mundane as a window cleaning gantry, which runs the length of the wave-like facade at roof level, has been turned into a feature. The gantry has been formed by 400mm box sections which have been faceted to accommodate the elevations shape.

"We needed something substantial as the cantilever puts torsion in the steelwork, and the box sections take the load back down to the connections," sums up Mr Swift.

Four goes into one

Above: The central section of the E shaped facility is formed by a propped portal frame stretching over three spans

Conder has designed and erected a lightweight steel frame for a new headquarters and warehouse to enable the distributor for grocery chain SPAR to expand its opportunities in the north of England, Victoria Millins reports.

James Hall & Company – one of six SPAR food distributors spread throughout the UK – is expanding its business with a major investment in a new headquarters and warehouse distribution centre in Preston. James Hall & Company began its association with SPAR in 1956 and now covers the whole of the north of England and needs to expand its ambient, and full range of temperature controlled areas as well as increasing its manufacturing and production facilities.

Main contractor Bowmer & Kirkland awarded Conder Structures a contract to design, supply and erect 1,700t of steelwork for the new centre on Bluebell Way in Preston near the M6. Conder was able to produce a lightweight steel frame by making use of cellular beams which also provided a good value option for the client.

Conder has developed the project as four separate sections rather than a single entity. "This mirrors the client's four main areas of operation which are fresh chilled foods, frozen foods, ambient grocery and food manufacturing and processing. Looked at from above the building takes on the shape of a capital 'E'," says Conder's Managing Director Jason Hensman.

The distribution centre contains a single span low bay portal building to receive goods with 17 dock doors. This is a 30m single span structure which is 5m to the underside of the haunch and fabricated from 610 x 229 x 101 beams. The roof is hipped at the internal end where it abuts to a propped portal and is divided from the adjoining 'goods out' section by a feature stair tower.

Stair towers are located on all elevations of the structure strategically located around much of the perimeter. Where there are no stairs the cladding has been designed to create the impression of a 'virtual stair tower' to maintain continuity on each elevation.

"On the opposite end to the hipped roof the

FACT FILE
James Hall & Company distribution centre, Preston
Main client: James Hall & Company
Architect: Cassidy & Ashton
Main contractor: Bowmer & Kirkland
Structural Engineer: Sleater & Watson
Steelwork Contractor: Conder Structures
Steel tonnage: 1,700t

Top: The new main entrance to the building incorporates a 15m high curved feature wall on a 4.25m radius

Above: The steelwork for the goods receiving area was completed first

Conder has developed the project as four seperate sections rather than a single entity.

structure has been designed to allow James Hall & Company further expansion opportunity in the future," says Jason Hensman.

Connected to the low bay portal is a high bay ambient warehouse. This measures 14m to the underside of the haunch, offers 8200m^2 of available space and comprises of 32m spans with hit and miss columns and a hipped roof at both ends. The 32m beams are fabricated from 533 x 210 x 62 beams. This and the other portal framed steelwork all include a 2m high parapet around the structures.

The central area of the facility will be a propped portal frame stretching over three spans. It will be 9.5m to the underside of the haunch and 95m deep from the front of the building.

The 150m x 30m offices and suites will be supported on 30 plate girders, each 10.66m long and 20mm thick, that connect to Conder manufactured plate girders formed from a 15-25mm plate. This particular design concept was developed on this project by Conder to deliver lighter and stronger beams for the offices. The beams are more economic and offer easier installation of M&E services.

The last of the four areas is a 54m by 40m low level portal which will function as the food production area. This is 6.5m to the underside of the haunch.

Visitors to the new building will be attracted to the main entrance by a 15m high curved feature wall on a 4.25m radius. This will be finished in stone cladding and will carry the company name above glazed window panels which compliment the design.

The glazed level one frontage is also curved on a 3.33m radius in the opposite direction to the main feature wall and is below a powered metal fascia and soffit. The windows above the entrance will form a balcony. Externally the building will be clad in horizontal bands of Kingspan flat stucco panels in white, merlin grey and cinnamon in six sets of panelling from the roof.

Erection of the steel frame began in May and with the main structural work completed at the end of August the project is on schedule for completion in October when James Hall & Company will commence the transfer from its current premises on Blackpool Road in Preston.

Stadium sprints to finishing line

With less than two years to go before its official handover, Martin Cooper spoke with ODA Project Sponsor Ian Crockford about how London's Olympic Stadium has sustainably taken shape.

The Olympic Stadium, the centrepiece for the London 2012 Games, is rapidly taking shape and on target to cross the finishing line for its 2011 handover. Time has always been one of the main challenges for this prestigious job, but the 80,000 seater stadium is set to meet its completion date, scheduled a full year before the Games to allow test events to be held.

As of last month (September) the majority of the steelwork programme had been completed, which included the rakers for the demountable upper tier of the stadium and the roof trusses.

With these upper sections in place the stadium's bowl shape is now visible for miles around and it has already become an east London landmark. "This is a ground-breaking project," says Ian Crockford, Project Sponsor for the ODA (Olympic Delivery Authority), commenting on the project which is now more than a third of the way into its programme. "This is not only the most sustainable Olympic Stadium ever built, but it's also the most flexible,"

After the Games the stadium is likely to be scaled down to a 25,000 seater by demounting the steel-framed upper tier, leaving behind a legacy facility for athletics and other sports.

"This is an important part of the project," adds Mr Crockford. "We are not just constructing a stadium to host the Olympics, we are also creating an arena which will benefit the local community for years to come."

Sustainability is certainly a buzzword at present, and this project has a number of green credentials to its credit. Only 10,000t of structural steel has been used on the project, making it the lightest Olympic Stadium to date. In stark contrast to the 40,000t needed for Beijing's Birds Nest Stadium, the majority of London's steelwork is demountable and can be recycled at a later date.

"This is not only the most sustainable Olympic Stadium ever built, but it's also the most flexible."

Other environmental initiatives have included taking truckloads off of the road network by making full use of rail links as well as nearby canals and waterways to bring materials to site. By the time the project is completed, it has been estimated that less than 50% of the stadium by weight will have been brought to site by road.

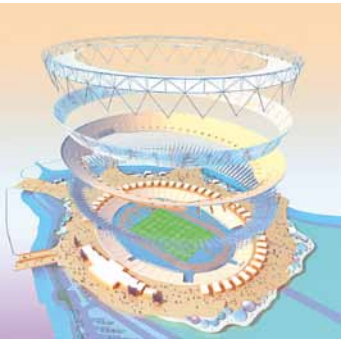
From the beginning of the project environmental issues have come to the fore. Over 33 buildings had

FACT FILE
London 2012 Olympic Stadium
Main client: *Olympic Delivery Authority*
Architect: *Populous*
Main contractor: *Sir Robert McAlpine*
Structural engineer: *Buro Happold*
Steelwork contractor: *Watson Steel Structures*
Steel tonnage: *10,000t*

Above: The final sections of the roof truss were lifted into place during September

Left: The tubular roof truss was assembled in 28 sections

Below: How the demountable stadium will work and the arena takes shape



to be demolished to clear the site for the stadium. These concrete structures have all been recycled with the material used throughout the Olympic Park.

As well as the desire to create a sustainable and long lasting stadium, the project's site has also played an important role in the design. The project team had to set about devising a plan to cope with the tightly enclosed site.

The stadium is hemmed in on all sides by two branches of the River Lea and an embankment containing one of London's main sewage arteries. In order that the stadium does not stretch out and over these waterways it has fewer concourses and public facilities. Instead, cafes, restaurants, fast-food outlets and shops will all be located in pods at podium level.

"This is one of the reasons we've achieved the desired lightweight and compact design," explains Mr Crockford.

Construction work has progressed well and Mr Crockford points out the project team has considerable experience of similar, if slightly smaller, projects. They all worked on the Arsenal Emirates Stadium and the conversion of the Millennium Dome to the O_2 Arena.

Early works saw more than 4,000 permanent piles installed for the stadium's foundations, while on top of this more than 100 × 5m-high concrete columns were erected to support the podium and lower ground floor which contains back-of-house facilities.

The site is also sloping and this has also been incorporated into the design by locating the athletes' changing rooms and warm-up areas in a basement area at the lower end of the slope beyond the bowl.

Above the concrete bowl, which consists of the lower and permanent tier of the stadium, Watson Steel Structures erected the initial steelwork. This consisted of 112 steel rakers, measuring 35m-long and weighing 25t each, to support the upper tier terracing.

Above this the signature roof was lifted into place in stages and completed during September. This steelwork consists of a 13m high lattice compression truss that rings the stadium and is formed by 900mm tubular steelwork. The truss was lifted into place in 28 sections, each 30m in length and weighing 90t. They were individually lifted into place by a 1,350t capacity crawler crane situated in the middle of the playing area.

"The steel compression truss is essentially a separate structure from the rest of the steelwork," explains Mr Crockford. "It is supported on a series of tubular columns which are founded at podium level."

Now the roof steelwork is in place a series of cable nets will be erected and tied back to the steel compression truss. The cable net will form the base for the 28m wide fabric roof covering which will provide protection for two-thirds of the spectators.

"The roof works in a similar manner to a bicycle wheel with the compression truss the rim and the cables the spokes," says Mr Crockford. "A ring of cables form the tension ring which acts like the central spindle of a bike wheel and the opening of which forms the roof opening over the field of play."

All the cables will be connected together at ground level and jacked into place early next year. A total of 14 x 18m-high floodlights will then be installed around the front lip of roof opening.

In the meantime, the stadium has not made any false starts and the project is sprinting towards the Games starting date of 27 July 2012.

Spans provide economy

A distribution centre on the outskirts of Bradford is set to help revitalise the local economy by creating thousands of new jobs. NSC reports from one of the UK's largest ever steel framed warehouse developments.

Most construction sectors have felt the chill winds of recession over the last twelve months. One sector, however, which has seen less of a drop in output is the construction of large distribution warehouses.

A steady stream of these buildings has continued to come on-line throughout the year, with some of the structures a considerable size. Good news for the steel construction sector is the fact that these developments always require large clear internal spans as well as an economical and fast construction programme. This is why the sector is overwhelmingly dominated by steel framed structures.

Business park developers are consequently some of the steel sector's prime customers and one example is ProLogis, the global provider of distribution facilities. The company has constructed a number of steel framed parks throughout the UK and one of its latest developments is located on the outskirts of Bradford.

Here on the 90-acre ProLogis Park Bradford a new 92,000m^2 distribution centre and office block is being constructed for Marks & Spencer (M&S). Measuring some 512m x 176m, this is said to be one of the largest distribution centres ever built in the UK.

A 50-50 joint venture build-to-suit agreement was signed between ProLogis and M&S in September 2008, and construction was able to begin early this year. ProLogis expects to deliver the building to M&S in the spring of 2010, and the retailer then plans to open the facility later the same year.

The client wanted to maximise internal space and to that end no internal cross bracing was permitted.

Early construction work on this former golf club site included a large earthmoving programme to level the sloping ground and provide a plateau for the new structure. Barrett Steel Buildings was able to begin its steelwork erection in July and will eventually erect close to 3,000t. Early works also included a soil stabilisation programme and the construction of some significant 9m-high retaining walls along the northern perimeter of the site.

In the future three mezzanine levels can be added into the structure

FACT FILE
Marks & Spencer Distribution Centre, Prologis Park Bradford
Main client: *Marks & Spencer, ProLogis*
Architect: *Stephen George*
Main contractor: *Winvic Construction*
Structural engineer: *BWB Consulting*
Steelwork contractor: *Barrett Steel Buildings*
Steel tonnage: *2,900t*

Above: The former golf club site will house one of the UK's largest warehouses

Impression of the warehouse and one of the attached office blocks

Concreting for the service yards, which surround the new warehouse, was also begun prior to the steelwork erection programme. "This made steel erection easier as there was a good surface all around the site, on which to run our cranes and cherrypickers," says Tony Walker, Design Director for Barrett Steel Buildings.

Barrett Steel Buildings has a design and build contract for all steelwork, and this includes the main warehouse development - including two attached office blocks, as well as stair towers, a link bridge and a future multi-storey car park.

One of the main challenges associated with the steelwork design arose due to the shed's size and proposed usage. The client wanted to maximise internal space and to that end no internal cross bracing was permitted.

Barrett designed a complex system of roof bracings which allow the wind loads to be distributed to a series of side bracings, strategically positioned to miss doors, offices and windows.

"Often in a warehouse like this with seven spans, there would be bracing in some of the bays," says Mr Walker. "On this project we had to secrete it away in the roof and then along some elevations."

The portal framed warehouse also has two attached office blocks, one a four storey structure located at the northern end of the shed and a slightly smaller three-storey block positioned along the eastern elevation.

One of the project's main features is the roof which includes a series of rafters which are all pre-set for vertical deflection between the ends of the haunches. This maintains a positive slope for the entire steel roof structure.

"Although the roof is curved there was a stipulation that there couldn't be any negative slopes. This would only create poor rainwater and snow water run-off," explains Mr Walker.

To cope with any possible thermal expansion the roof design also includes a thermal movement joint which has been positioned half way along the building's length.

Future expansion and adaptability have played a big role in the design of this project, as BWB Consulting Project Engineer Dom Ginty explains: "The steel frame has been designed to accept an additional three levels of mezzanine, which would connect to the portal frame at first floor level."

M&S may include these mezzanines at a later date when it has the facility up and running. A steel 25m-long link bridge is also being constructed which spans one of the service yards and links one of the office blocks with the multi-storey car park.

"The multi-storey car park is planned to be built next year," adds Mr Walker. "In the meantime the bridge will be in place and used by staff to access an existing surface car park."

The warehouse is being constructed to achieve an 'Excellent' BREEAM rating and in addition ProLogis has committed to a carbon neutral shell, by using Corus Confidex Sustain®.

Energy solution from waste

Above: All steelwork has been galvanised for added durability

Housed within a large steel frame, the UK's largest energy from waste plant is taking shape on the banks of the River Thames in north Kent. Martin Cooper reports.

Alternative methods for waste disposal is one of the main challenges facing local authorities throughout the UK. Coupled with the need for greener or renewable sources of fuel, a number of energy from waste plants are planned up and down the country.

One such facility in Belvedere, Kent has secured planning permission and funding, and is rapidly taking shape on the southern bank of the River Thames. To be operated by Cory Environmental, it will be the UK's largest energy from waste plant when it goes online in 2011.

Being built on a brownfield site which once housed a Borax works, it will process more than 585,000t of municipal and commercial waste per year, and provide 66MW of electricity to the local grid. Making use of its riverside location, a new jetty is being constructed as part of the overall scheme, and this will allow the majority of waste to be delivered by barge, removing 100,000 truck movements annually from the roads. As the bulk of the waste will be sourced from four central London boroughs it is also envisaged that the facility will

Left: Much of the facility requires large open spans to house the processing equipment

Right: Impression of the completed plant and its jetty which will accept the majority of the incoming waste

make a real contribution to the capital's ability to meet its landfill diversion targets.

The environment and sustainability have played key roles in the design of the project as well as the future plans for the facility. Riverside will be the first plant in Europe which is designed to reach at least a net electrical efficiency of 27%. The plant is expected to exceed this limit by implementing multiple recovery technology steam conditions. The site is also located in an area earmarked for future development, and with this in mind the water-steam cycle of the plant has been designed for possible off-take of heat supply for approximately 60,000 local homes.

Main process contractor for the project is Swiss-based Von Roll Innova, a company with a wealth of experience in similar projects around the globe. Design and build sub-contractor for the civil engineering and building elements is Costain and it started on site in July 2008.

Construction of the main building began towards the end of last year. It is a massive structure and covers an area of over 13,000m^2, with a curved roof rising to a height of 55m. The majority of the main frame of the building is being erected with structural steelwork. This will eventually include more than 2,000t of steel, with a similar amount of steelwork being installed by another subcontractor, for internal supports and walkways around the plant's equipment.

"The key to this project is integration," explains Nick Hayes, Divisional Director for Bourne Steel. "We, as well as all the other sub-contractors, are all working around each other. In some areas steelwork is being erected first, but in other sectors the equipment is installed first and we then have to come along and thread the steel columns, some 30m long, between large pieces of processing kit."

Items such as water tanks and the turbines are too large to be installed once the building is complete, so they are being assembled on-site and placed in their final locations prior to the main frame being finished. This will also ensure the facility is ready to meet its important late 2010 commissioning period.

Items such as water tanks and the turbines are too large to be installed once the building is complete, so they are being assembled on-site and placed in their final locations prior to the main frame being finished.

"We have some large crawler cranes on site which are shared by the sub-contractors, and many trades working around each other, so collaboration is a key issue on site," says Nick Lowe, Costain's Agent for Steelwork and Cladding

Much of the steelwork will be erected on top of concrete walls, such as the waste bunker where 20m long steel columns will extend this part of the building upwards to connect to the steel roof. Two overhead grab cranes, to pick waste and deposit it into feed hoppers, will be suspended from the upper steelwork.

The steel framed building integrates the key process under one roof, this includes the turbine hall, boiler house, flue gas treatment hall and a control room, which will be suspended internally from the roof by 18m-long trusses.

All of the steelwork used for the project's frame has been galvanised for durability. One of the largest galvanising baths in the UK has been used to accommodate the large truss sections.

Many of the trusses and column sections are in excess of 30m and consequently they are brought to the project in smaller sections are assembled on site. Many of the trusses are 18m long x 4m deep and these are brought to site in halves.

The stability for this vast building is derived from the walls, but a lot of temporary bracing is

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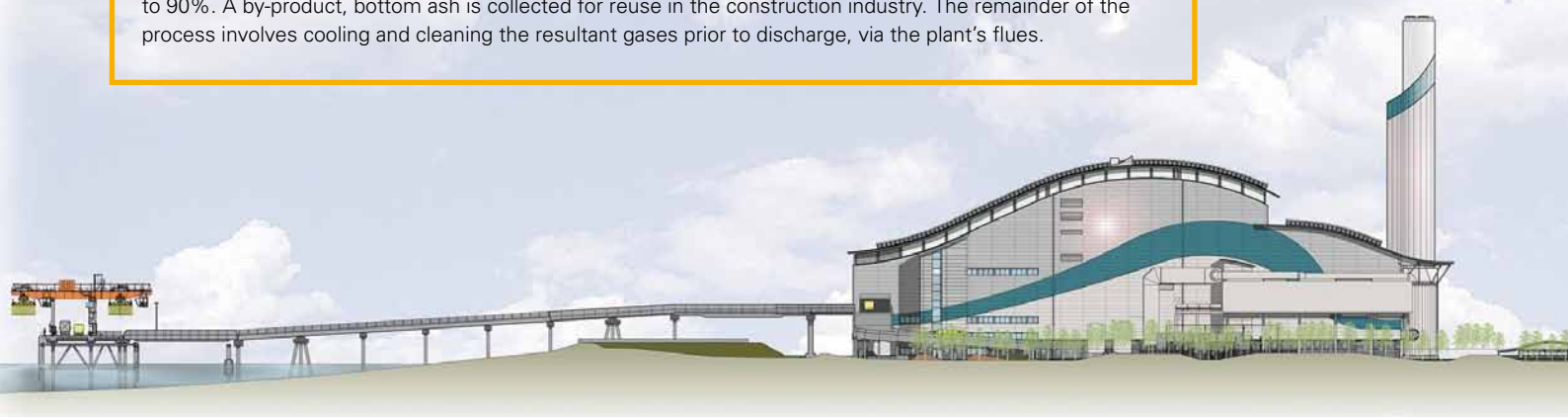
FACT FILE
Riverside Resource Recovery, Belvedere, Kent
Main client: *Cory Environmental*
Architect: *Race Cottam*
Main contractor: *Von Roll Inova*
Construction contractor: *Costain*
Structural engineer: *Jacobs Engineering*
Steelwork contractor for main frame: *Bourne Steel*
Overall steel tonnage: *4,000t*

Rough guide to what goes on inside the Riverside facility

Waste from the jetty (and approximately 15% by road) will be deposited into the waste bunker before cranes then feed it into hoppers for processing via three process trains. Each train has a four-pass steam generator. Electricity is generated from the produced steam and the waste is reduced in volume, by burnout, by up to 90%. A by-product, bottom ash is collected for reuse in the construction industry. The remainder of the process involves cooling and cleaning the resultant gases prior to discharge, via the plant's flues.



Left: As well as the main frame and metal decking, there is also another 2,000t of internal steelwork in the project

> being installed by Bourne as it erects the main frame. "The temporary steel will remain until we start erecting the roof beams that tie the building together," explains Mr Hayes.

The steel wave-like shaped roof, which will reach a height of 55m, is such a challenging and eye-catching shape that all the 36m-long cellform beams will be trial erected, in order to get the correct geometry as there is no constant radius.

The sub-structure and some other parts of the superstructure are constructed with more than 25,000m^3 of concrete. One of the critical elements of the project so far was the slip forming of the waste bunker, which required 4,000m^3 of concrete to be placed during a 24 hour programme which lasted for three weeks.

This large concrete box is approximately 60m long x 30m wide x 30m high, and is partially sunk into the ground. This is where trucks will deposit waste for the initial process within the facility. An adjacent tipping hall will allow up to 12 trucks to tip waste into the bunker via chutes cast into the slip formed wall.

"This a complex and challenging project," sums up Mr Lowe. "But a type of job I hope we will be involved with again, as more of these plants are built in the UK."

The right information at the right time

The BCSA's Pete Walker explains what the revision to the CDM means to the steel construction industry and how in particular the flow of vital information will be aided.

One of the strongest messages the Health and Safety Executive (HSE) wanted the construction industry to take from the revision of the Construction (Design and Management) Regulations 2007 (CDM) and particularly the Approved Code of Practice CDM L114 (ACoP) is that the communication of information is critical to whether a project is successful or not.

The obvious role that was not working in the original CDM was that of the planning supervisor, so the HSE created the role of the CDM Co-ordinator to strengthen the flow of communication between what the client wants and what can be constructed.

The key role of the CDM Co-ordinator is to ensure that those involved in the design work (before and during construction) have the information they need to make the decisions necessary in the design process.

So where does this leave the sub contractor that was appointed by the principal contractor to fabricate and erect the steelwork but cannot get the design philosophy needed to erect the structure safely, and the consulting engineers that always state that the temporary stability of the structure has absolutely nothing to do with them?

The BCSA communicated with the HSE the concerns raised by the members on the difficulties in getting information relevant to design and construction from the Principal Contractors.

The HSE said *"if sub contractors are not receiving the information which they need in order to plan and complete their work safely on site then there is a lack of compliance with the Regulations on the part of those who are failing to supply the information"*. The two duty holders that could be found to be failing in their compliance with the Regulations are the Client and the CDM Co-ordinator. The HSE also stated *"Ultimately if the CDM Co-ordinator does not fulfil his responsibilities, there is a legal route back to the client who is responsible for his appointment and competence"*.

The ACoP states that the client has one of the biggest influences over the way a project is run. They have substantial influence and contractual control and their decisions and approach determine: Whether the team has the information that it needs about the site and any existing structures. Clients must make sure that the relevant information likely to be needed by designers, contractors or others to plan and manage their work is passed to them in order to comply with regulation 10 which says: Where design work continues during the construction phase, the pre-construction information will need to be provided to designers before work starts on each new element of the design. Similarly, where contractors are appointed during the construction phase, each contractor (or those who are bidding for the work) must be provided with the pre-construction information in time for them to take this into account when preparing their bid, or preparing for work on the site.

CDM co-ordinators must co-ordinate design work, planning and other preparation for construction where relevant to health and safety and promptly provide it in a convenient form to those involved with the design of the structure; and to every contractor (including the principal contractor) who may be or has been appointed by the client, such parts of the pre-construction information which are relevant to each.

In the communications with the HSE the BCSA quoted the withdrawn guidance GS28 Part 1 Safe Erection of Structures – Initial Planning and Design as a valuable guidance for those involved in steel erection. The HSE stated *"GS 28 is out of date and revision of the guidance is not a priority for HSE, nor is it likely to become one in the near future, although GS28 series has been withdrawn, most of the practical advice in GS28/1 remains sound and provides a basis for compliance by all parties with CDM"*.

The BCSA is considering a review of the guidance note on the Safer Erection of Steelwork draft that was developed in 1999 and is based on the GS28 series. A number of publications are already available on the BCSA web site www.steelconstruction.org that reflects some aspects of the GS28 series.

Also available free from the BCSA is a copy of 'Allocation of Design Responsibilities in Constructional Steelwork' a publication addressing the responsibilities for identification and sharing of design information in a timely manner.

A sustainable landmark

A large vocational college is changing its name and constructing a new steel-framed and sustainable teaching block. NSC reports on a project making big news in Sheffield.

The greenest major development the city has seen, a sustainable landmark and a milestone for local education are just some of the superlatives that have been mentioned in connection with one large construction project currently under way in Sheffield.

Known as Castle College, the project is on a site that houses one of the two campuses for Sheffield College. However, once the redevelopment of the site is complete in 2010, a name change has been decided on to reflect its strong ties to Sheffield, its people, their skills and the local economy.

Julie Byrne, Director of Castle College, explains: "We are the largest vocational training resource for the city and the new building will provide our students with outstanding facilities. The structure is also a dynamic catalyst for change, which includes a new name - Sheffield City College."

Befitting a college with a regional and national reputation, and one which has won many awards, the client wanted a landmark building which would be visible from the city centre.

The college is perched on a hillside to the east of the city and the topography has been used in the architectural design, with the building going up instead of out which will achieve greater visibility from its environs.

Another important consideration is the college's desire for the building's appearance to underline its attitude and aspirations, so sustainability is a priority feature.

The main new ten-storey steel-framed tower block will be topped with a trio of turbines to generate power for the college; sedum roofs will absorb pollutants, provide a habitat for insects, reduce run off and direct heat on the building, so the temperature is controlled naturally; while wildflower meadows around the college grounds will soften the site's perimeters.

As well as the construction of a ten-storey main teaching block, which also features a seven-storey glazed atrium, the new college buildings will also consist of a four-storey catering block and a four-storey steel-framed sports hall building.

Constructing new college buildings on the site of an existing and functioning college has meant the entire project has been sequenced to incorporate staged demolition and relocation of students and teachers.

FACT FILE
Sheffield City College
Main client:
Sheffield College
Architect:
Jefferson Sheard
Main contractor:
JF Finnegan
Structural engineer:
Eastwood & Partners
Steelwork contractor:
Hambleton Steel
Steel tonnage: *850t*

So tight was the required accuracy of the curved sections that Hambleton undertook a trial erection prior to delivering them to site.

Left: The new teaching block is situated on a steep hillside and will be visible from the city centre

Below: The sports centre takes shape adjacent to the main block

One of the initial tasks was the completion of the concrete framed catering block which was recently handed over to the college. This allowed the old canteen to be demolished making room for the major works to begin as well as improving site access.

The main tower consists of a concrete framed basement car park on top of which is the steel framed tower block and atrium.

"The basement car park is set on a 7.2m grid, which allows three cars per bay," explains Mike Young, Project Engineer for Eastwood & Partners. "The grid for the classrooms above had to be set at 6m centres to accommodate the required configuration, so we have a concrete transfer structure at ground level and then a steel frame above. Steel was chosen for lightness and speed of construction."

Stability for the tower block is provided by two cores at either end of the building, these were constructed at an early stage in the programme along with the basement and transfer structure.

Hambleton Steel have fabricated and erected all steelwork for the project as well as installing metal decking and edge protection. Once the main frame for the teaching block was completed, Hambleton's next job was to erect the attached atrium.

"The atrium was the most technically demanding aspect of the contract as it involved high degrees of accuracy in shop manufacture and tight tolerances on site for the glazing systems," says Mike Dixon, Hambleton Contracts Manager.

The seven-storey atrium will be one of the main features of the completed project as the predominantly steel and glass structure curves inwards at the top. The fact that the atrium is positioned on the western elevation also means it will be visible from the city centre below. The shape of the atrium also dictated the choice of steel for its frame.

A series of 3D lattice trusses made from CHS sections form the frame for the atrium. These trusses incorporate curvature of 15 degrees as they slope upwards and inwards towards the roof and are tied together with horizontal bracing at alternate floors. At roof level the trusses are tied back to the tower block via 5m-long steel beams, while a series of glulams, fixed to the top of the lattice trusses continue the atrium's curvature above the seventh floor level.

The 2.5m wide lattice trusses were brought to site in two 18m-long sections and bolted together via sleeve connections during the erection process. However, so tight was the required accuracy of these curved sections that Hambleton undertook a trial erection prior to delivering them to site.

"We set them out on the ground at our yard fully assembled," says Mr Dixon. "The curvature had to be checked and as they are braced in three directions we had to make sure they fitted exactly as there was no margin for error."

The atrium's exterior finish will be a combination of cladding and glazing in alternating 3.5m and 2.5m wide vertical bands. The glazing will be fitted in between the trusses, meaning they will not be visible from the outside.

The three turbines which will be positioned on the building's roof also posed a challenge. These large pieces of equipment will be subject to large horizontal and wind loadings. The two outer turbines will be founded on cross frames which are connected to internal columns which have been extended up through the roof. Unfortunately the tower block's column grid pattern does not quite accommodate the middle turbine.

"This one is founded on a steel transfer structure which takes the loads back down to the floor below," says Mr Young.

During September Hambleton completed the final phase of its steel package which consisted of the sport hall building. This steel-framed building is attached to one of the tower block's cores and sits on a ground level concrete transfer structure.

A series of 18.5m long trusses form the sports hall area, while the southern end of the building has three floors set out on a 6m grid. These areas will be changing rooms at ground level with two floors of teaching rooms above.

Completion of the college buildings is scheduled for mid-2010. Summing up John Taylor, Chief Executive, The Sheffield College says: "We are very excited by this forward thinking building. We are enabling Sheffield to be a leader in environmental regeneration.

Below: Steel's speed of erection has played a key role in the project's development

They've changed the density of concrete — or have they?

The bulk density of reinforced concrete has been increased. SCI's Alastair Hughes explains how this affects the steel construction industry.

Introduction

The density of concrete may seem rather an out-of-the-way subject to the readership of NSC, but it is one which matters to us. Most steel structures, composite or not, are burdened with concrete in one form or another. There is a move afoot to talk up the density (or, if preferred, unit weight) assumed for concrete in structural design. This asserts itself in Eurocode 1: Actions on structures, but it does not follow that a xenophobic and defensive response is in order. If we have been routinely underestimating the weight of concrete, at the expense of safety, we should be prepared to change our ways.

Background

Since time immemorial, structural designers have, almost automatically, made the assumption that the density of reinforced concrete is 24 kN/m^3, and before that the very similar 150 lbf/ft^3. If pressed to justify this, we would acknowledge that the density of concrete does vary, but not all that much, and in many respects not controllably. It is therefore appropriate to adopt a nominal, not to say characteristic, value. Variation in density, like variation in cross-section dimensions, is one of the things the load factor is there to cover. In fact, a standardized density is the only realistic starting point for routine structural design. Bridge designers balancing cantilevers may have time and motive to grind finer but building designers, on the whole, do not.

How concrete varies

Concrete is a mixture, and its density depends on its ingredients and their proportions. Density of regularly used aggregates can vary strikingly between, say, limestone and granite. Entrained air reduces density and free water in the pores increases it. But the most important variable is probably the reinforcement. Steel is about 3.25 times as dense as plain concrete, so if 1% by volume is rebar replacing concrete density increases 2.25%. While 1% by volume would be above average for typical mesh-reinforced composite slabs, it would be well below average for reinforced concrete superstructure generally. One of the arguments for an increase is that this average has been on a consistent upward trend since the days of 150 lbf/ft^3.

Water in concrete

Part of the water in concrete is permanent, either chemically combined in the cement paste or adsorbed. However a certain amount of free water is needed for fluidity at the time of placing, so it is always present even in the best designed mixes incorporating admixtures to reduce it, and the temptation to add excess of it on site (at the expense of the strength and durability of the end product) is not always resisted. So it is a rather uncertain quantity of this free water which evaporates from the concrete as it dries to a moisture content in equilibrium with the surrounding atmosphere, and the density of the concrete reduces in consequence (slight volumetric shrinkage notwithstanding). The advice of EN1991-1-1 is that the density difference between unhardened (meaning 'wet') concrete and the 'dry' density of the same concrete months later should be taken as 1 kN/m^3. A vision of over a centimetre depth of captured and condensed water is one to contemplate if pressured to lay an impermeable finish on a newly cast composite slab.

This extra 1 kN/m^3 represents another, separate, challenge to established practice, which has tended to assume half that difference, if anything. For the design of steel beams to support wet concrete, it is not good news.

USFBs or CONCRETE ?

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Engineer: PWP Consulting Engineers

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Engineer: Whitby Bird

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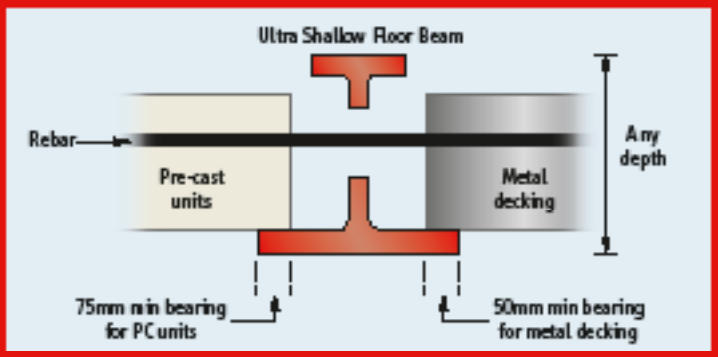

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ASD Westok. Part of the ASD metal services group.

How EN1991-1-1 presents the changes

EN1991-1-1 is subtitled 'General actions – densities, self-weight, imposed loads for buildings'. Section 4, 'Densities of construction and stored materials' is very short, but a Note points users towards informative Annex A, a set of tables at the back. Section 4 includes the statement that 'Mean values should be used as characteristic values'. In other words no attempt to target a 95% probability of non-exceedance, though exception is made for materials with a 'significant scatter' of densities. The use of mean values is in line with predecessor codes. Section 4 also states that 'If a reliable direct assessment of the densities is carried out, then these values may be used' – in lieu of those in Annex A, we may imply.

Annex A includes Table A.1 for concrete and mortar. For 'normal weight' concrete, neither lightweight nor heavyweight, it quotes a density of 24 kN/m^3. This is for plain (unreinforced) dry concrete; footnotes instruct: 'Increase by 1 kN/m^3 for normal percentage of reinforcing and pre-stressing steel' and ditto for unhardened concrete. (The table also features 'density classes' of lightweight concrete, but since these cover the entire spectrum of density it is hard to see the point.)

For normal dense concrete, the message is clear. Break the habit of a lifetime and use 25 kN/m^3 instead of 24 kN/m^3 for routine concrete design. Add 1 kN/m^3 for design at the wet concrete stage.

This is advice, not command. It is contained in an 'informative' annex, not a 'normative' one, so users are not compelled to take the advice (though contrary designers should perhaps anticipate the question 'where is your reliable direct assessment?').

Informative annexes are subject to national decision on their status. The UK National Annex decides that Annex A 'may' be used, which seems deliberately lukewarm next to the decision that Annex B (concerned with vehicle barriers) 'should' be used. One day there is a thesis to be written on Eurocode semantics, but in the meantime we have buildings to design.

What are we to make of it all?

The concrete sector has already decided. To quote from the admirable booklet entitled 'Getting started' published by our counterpart, The Concrete Centre, 'The key change to current practice is that the bulk density of reinforced concrete has been increased to 25 kN/m^3.' No equivocation there!

Of course the concrete doesn't read 'Getting started' and (like some of us) has no Code change on its radar. If we have been underestimating its density all these years, the inescapable conclusion is that we should correct ourselves, not just in design to the new codes but in design to the old ones. We should thank EN1991-1-1 for bringing the matter to our attention, but the overdue correction is independent of the code change. The starting point for design to current UK codes is meant to be the mean density of the material – exactly as in the Eurocode.

That said, there remains a suspicion that the 'density change' owes something to cold feet. The reduction in dead load factor from 1.4 in current codes not just to 1.35 but to as little as 1.25 in EN1990 is favourable to the competitive position of concrete, but leaves responsible people conscious that a sizeable portion of the margin between action effect and resistance has vanished. Increasing the density of concrete redresses the balance a little, and may have helped make the calibrations used in

support of the 1.25 factor more persuasive.

A blow to the steel sector?

For wet concrete, this 1.25 factor is not on offer. This is because EN1991-1-6, the Part concerned with actions during execution, reclassifies wet concrete as variable load, to be factored 1.5. So the increase in density is compounded by an increase in load factor, and a 40% real terms increase in the constructional live load for a beam from 0.5 kPa (factored 1.6) to 0.75 kPa (factored 1.5) completes the triple whammy for a typical composite beam at the wet concrete stage. This is probably an unforeseen consequence rather than a conspiracy. Calibration concerns must have been focused elsewhere.

SCI's recommendations

SCI has reviewed the combined effect of the Eurocode provisions on the competitive position of composite construction. To an extent the negatives dwelt on in this article are countered by the reduced partial factors and other positive features of the new codes, and of course the wet concrete stage is only one of several which can control member sizing.

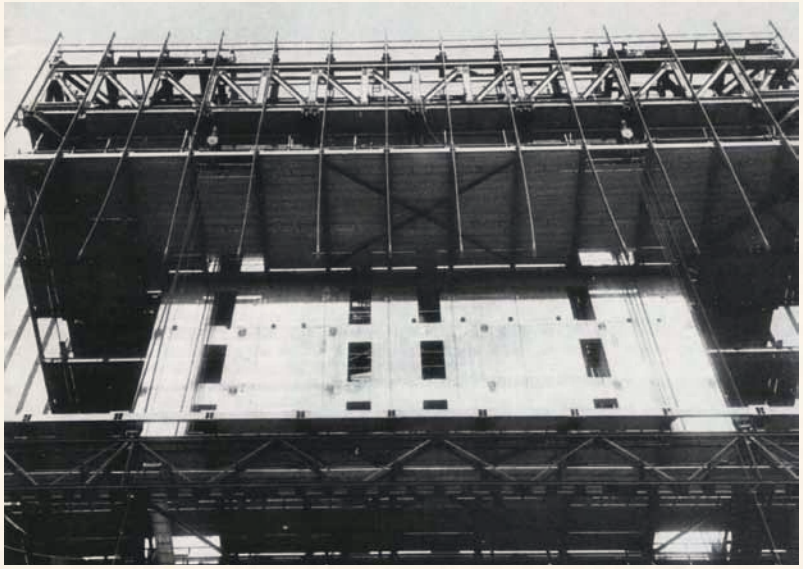
Our conclusion is that the increase in the density of concrete to 25 kN/m^3 should be implemented, partly because whatever the rights and wrongs of the situation it would be ridiculous to expect designers in practice to switch from one density to another just because there is a change in the material supplying the resistance. Responsible designers, who recognize that this is correcting a historic wrong, may choose to adopt 25 kN/m^3 in their remaining future designs to UK standards.

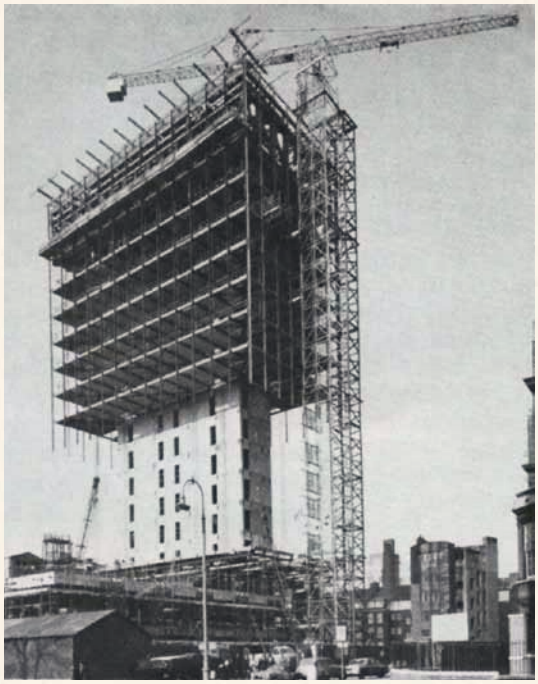
However 26 kN/m^3 for wet reinforced concrete in typical composite slabs is excessive and unreasonable, if only because the reinforcement content is below average. A design wet density of 25.5 kN/m^3 (of which 0.5, for reinforcement, could be factored 1.35 along with the decking) seems ample, and will be used in future SCI design examples for the wet concrete stage using normal dense concrete. For the final stage, 25 kN/m^3 will be used, a little generously perhaps, for the reason stated above.

SCI also endorses the use of the higher (variable) load factor for wet concrete. This is clearly the intent of EN1991-1-6, even if some ambiguity remains.

For lightweight concrete with 14 mm Lytag coarse aggregate and conventional fine aggregate (sand), SCI design examples will assume a wet density of 19.5 kN/m^3 (of which 0.5 is reinforcement allowance) and a dry density of 18.5 kN/m^3. These are in the middle of the range quoted by the aggregate supplier.

The density of reinforced concrete has been increased to 25kN/m^3





Head Office for Hearts of Oak Benefit Society

Above: View of podium steelwork

Above right: View of the construction at the halfway stage

The Hearts of Oak Benefit Society, which operates within the framework of the Friendly Societies Act, has grown from humble beginning in 1842 to become one of the foremost friendly societies in the country. It is appropriate, therefore, that the new Euston Road, London, Headquarters building should be a prestigious edifice and, because of the growth record, that every available square foot of the site should be used effectively.

A normal tower block was the ideal solution but the height necessary to achieve the required usable office space was unacceptable from a town planning viewpoint because of the proximity of St Pancras Church. The shape of the building as dictated by the Town Planning Authorities led the Society's Architects to design the building on the suspension principle so that there are no columns intruding on the office floor space, and with a podium of three storeys, inclusive of basement, which further compensates for the loss of space due to reduction in height.

The new building is but the fourth of its type in the UK, the other three also being in London. Of the examples of tall suspended buildings elsewhere in the world, the architects and engineers visited those of the Common Market in Brussels, BP in Antwerp and Philips in Eindhoven. Valuable information was gained from each but the Philips building displayed principles most applicable to the Hearts of Oak development. Unlike the Philips building, however, which has the floors suspended only from the long sides of the core, the Hearts of Oak building has suspenders on all four sides. This was necessary to allow the east side of the building to overhang the existing pavement, for which, down to third floor level, agreement was reached with the Greater London Council. The suspended floors thus project the same amount on all sides from the central core to give plan dimensions of 58ft × 106ft. The core itself is 18ft 9in × 67ft 3in.

Construction

The construction of all buildings of this type follows the same principles. A concrete core is built to house stairs, lifts and other services and to act as a stiff member to transmit all horizontal forces to the foundations. Then an umbrella structure is cantilevered out at the top and from the periphery of the suspenders are hung to support the floors.

In the case of the hearts of Oak building the concrete core, supported on a raft surmounting under-reamed piles reaching 40 to 50ft down into the London clay, was built by traditional methods with a vertical tolerance of only ±½in in some 200ft.

At the top of the core, eighteen specially constructed anchor blocks of high yield stress steel built into the core cap. Opposite anchor blocks are connected with pairs of cables each consisting of thirty four 7mm wires, post tensioned in two stages to take loads of up to 120 tons per cable. The anchor blocks set diagonally at each corner of the core are held back by similar pairs of cables anchored to the core itself.

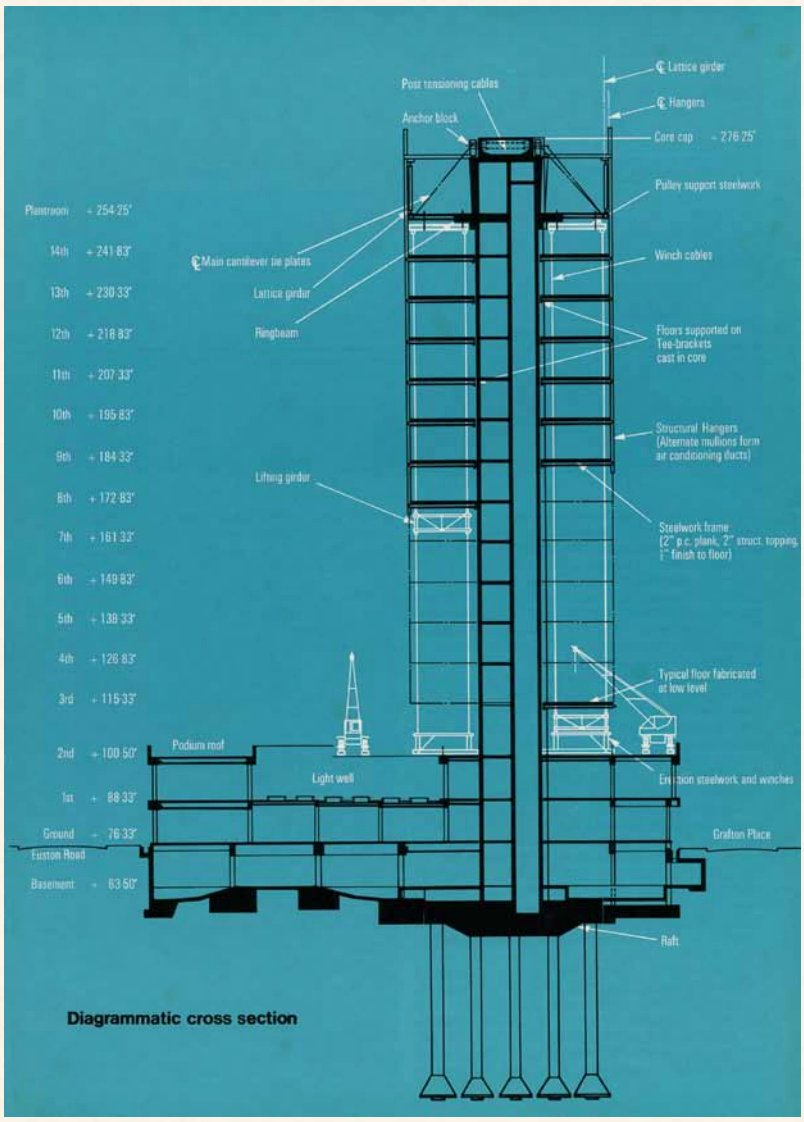
During erection, the cables are protected against corrosion by a surface coating. They will be grouted up only after all umbrella steelwork is complete and the final tensioning has been carried out. The anchor blocks will then be completely encased in concrete.

With the core completed and the anchor blocks in position, erection of the steelwork, generally of high yield stress quality, could begin.

The main elements from which the floors are suspended are 15ft 1in deep lattice girders at the periphery of the building. These are supported at plant room floor level by a series of cantilever struts, consisting of four 17in × 4in channels built into a concrete ring beam on the outside of the core, which are in turn supported by ties from the anchorage blocks. Each tie comprises three 18in wide plates in parallel, the outer ones being ¾in thick, and the central one, 1½in thick. The top booms of the lattice girders are tied back to the core through plant room and roof steelwork.

The hangers, suspended outside the lattice girders, are at 8ft 1¼in centres around the building. At the four corners, 8in × 8in × 1in angles are used for the full length of 166ft 9in. All other hangers consist of two 9 × ⅝in plates from the top down to 7th floor level and then they are single plates of the same section.

At the top of the building the hangers extend to a height



of 3ft above the highest roof level to form a parapet. They are tied together on their inner edges by a parapet rail of rectangular hollow section. There is a similar extension below the 3rd floor (the bottom suspended floor). With the rectangular hollow section mullions placed centrally between them, the hangers form a uniform vertical feature.

In the design and fabrication of the hangers, account had to be taken of extensions due to loading and movements due to temperature changes. The components of each hanger were therefore laid out in the shops against a full length template, the splices are made with high strength turned barrel bolts., and the floor beams are connected to the hangers by a single 1¼in diameter pin of high yield stress steel to permit articulation.

The floors consist of simple steel framing with 2in thick prestressed concrete planks surmounted by 2in of structural topping. Although erection proceeded from the top down, the floors were in fact prefabricated (except for the topping) in two halves on lifting rigs mounted on top of the podium and winched up. Erectors travelled on the completed half floors and fixing was a reasonably simple matter.

The steel floor beams trim into a fascia channel, which also serves to support cladding, at the outside and into another channel fixed to brackets set in the concrete core. The inner ends of the beams rest on rocker bearings so that, with the pinned connections to the hangers, articulation is possible at both ends.

The floor steelwork, protected against fire by sprayed asbestos, will be concealed by a suspended ceiling above which air conditioning ducts and other services will be housed.

Cladding

The Hearts of Oak development is unique in that the hangers are external to the cladding. This has been done to obtain the maximum usable floor area and the achieve a prominent external architectural feature. All the hangers will be clad in stainless steel which will be shaped to form vertical tracks for the maintenance cradles. The intermediate mullions, likewise external to the enclosing envelope and clad in stainless steel, will also serve a dual purpose. In addition to supporting the glass and block granite infill panels, they will be used as air conditioning ducts and will thus help to conserve space inside the building. The glass itself is unusual; the type to be used has been specially chosen because of its anti glare and insulating properties so that occupants will be able to work in comfort and the air conditioning plant will be smaller because of the reduced refrigeration required.

Podium

This consists of a basement for parking cars and two floors for additional offices. The basement and the exterior beams above ground level are of reinforced concrete construction but all interior framing for the offices is of steelwork, high yield stress steel again being used to minimise weight and conserve space. Large circular holes in the webs of the floor beams throughout their length serve for the passage of services within a limited floor depth.

A roof garden is planned for the open area above the first floor, whilst the part under the suspended building will provide a covered concourse.

Architects for the development are Sidney Kaye, Eric Firmin & Partners, the Consulting Engineers are H L Waterman & Partners and Basil A Cohen & Partners are the Quantity Surveyors.

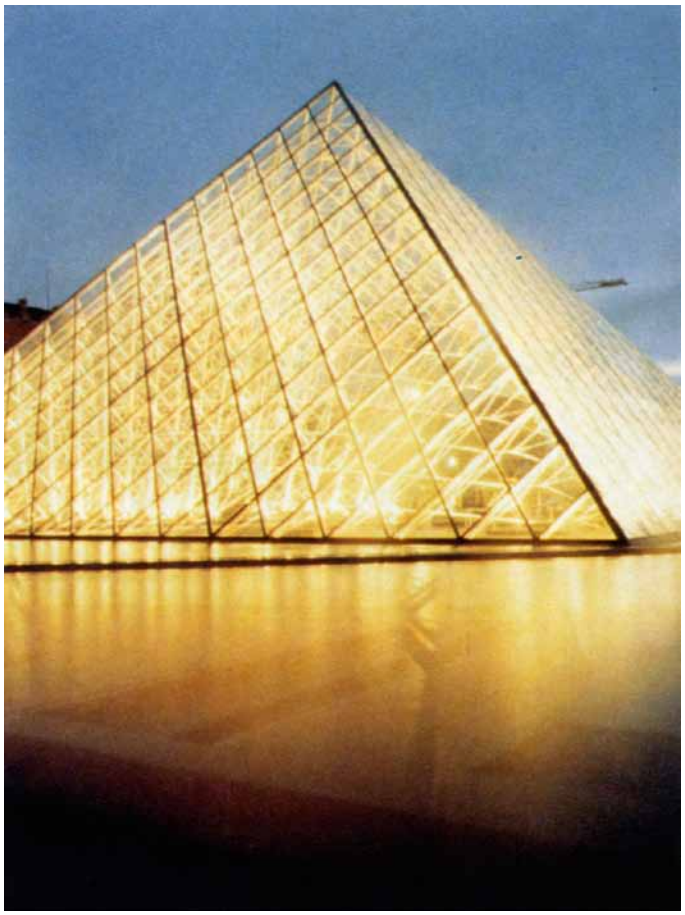
Construction of the core and podium commenced in June 1967 and it was topped out complete with core cap and anchorages in October 1968. The steel work erection took 24 weeks and the project is due for completion in late 1969.

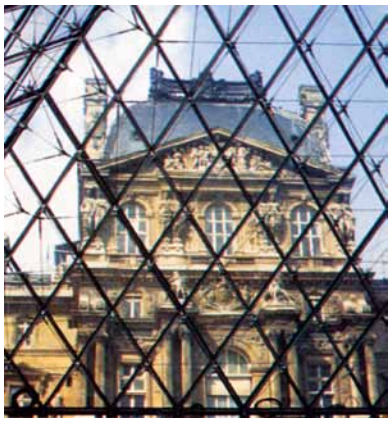
Above left: Model showing the whole concept

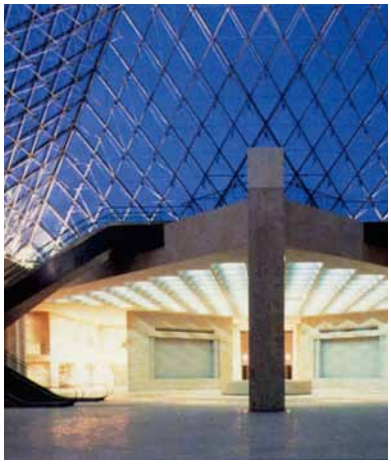
Above: Diagrammatic cross section of the project

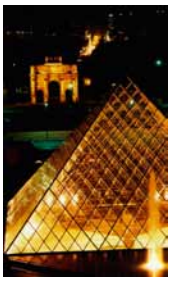
La Pyramide du Louvre

1989 ECCS design award winner









Judges' Comments: **An outstanding solution to a unique project incorporating many important technical details enabling the minimum amount of steel to be visible.**

In the heart of the Napoleon courtyard which marks the historical centre of Paris, the Louvre Pyramid is a steel masterpiece which opens the way to the new entrance to the Louvre Museum. It is the keystone of the Grande Louvre Project. This superb construction will enable the 4.5 million yearly visitors entering the new entrance hall to benefit from a sky lit route to their directions, thanks to the built in transparency. The pure lines of the pyramid, timelessly modern, are a symbol of the revival to this great museum.

Each side of the pyramid consists of a system of diamond-shaped cones produced by 128 intercrossing lattice girders of 16 different lengths. The outer faces of the girders consist of stainless steel bars welded to cast nodes. 16 rows of guy wires hoop the system to provide structural integrity under the strains resulting from wind, temperature variations and the concrete support.

CFEM, a subsidiary of USINOR SACILOR, which also incorporates the company GUSTAVE EIFFEL had to cope with a computing and development challenge involving the production of the finest possible structure within the boundaries of the geometry specified by the architect.

The cast nodes were produced by the lost wax process. The ancient technique put to use with stainless steel enabled the achievement of a high quality surface finish.

The guys providing the structural tension are comparable to those of large modern sail boats and develop exceptional technical features. The outstanding features of the Pyramid are:

- its lightness and the transparency resulting from the slenderness of every component, from the high standard of the glazing laid and from the absolute flatness of the sides
- exceptionally close building tolerances (<1mm)
- structural complexity resulting from the number of nodes and modelized bars.

The concurrent execution of both concrete structures and erection required use of a structural bearing scaffolding. Leg jacks were used to make up for the prestressing fluctuations of the bearing girders. Close geometrical testing took place after each erection weld. Ballasts simulating the weight of each glazed panel were carried out to correct the flatness of the sides before the panels were put in place. The length of the guys was adjusted as required by the actual 3D location of each node.

The Pyramid was completed within 30 months including eight for design, eight for fabrication and 14 for erection (January 1986 – June 1988).

Owner: Establissement Public du Grand Louvre
Architects: Ieoh Ming Pei
Structural Engineers: Ieoh Ming Pei & Partner
Steelwork Contractor: CFEM

AD 338
Guidance on the use of stainless steel

The Advisory Desk is often asked questions related to the use of stainless steel in construction. Questions typically concern design, fabrication, erection, corrosion and other general aspects. The purpose of this Advisory Desk Note is to give a summary of useful sources of relevant guidance for architects and engineers, most of which is freely available on-line.

Resources developed by SCI

SCI has developed extensive guidance on the design of stainless steel and hosts two web sites from where information may be downloaded (*www.steel-stainless.org* and *www.stainlessconstruction.com*). The following resources may be obtained from those web sites or, in some cases, paper copies or CDs are available.

Design Manual for Structural Stainless Steel, Third Edition
This Euro Inox publication offers comprehensive design guidance aligned to the Eurocodes. The publication may be downloaded from *www.steel-stainless.org/designmanual*. Paper copies or CD copies may be ordered from the Euro Inox web site (*www.euro-inox.org*) A commentary giving the background to the recommendations is also available, on-line.

Structural Design of Stainless Steel
This SCI publication (P291) offers comprehensive design guidance, including design tables, for design to British Standards. The publication may be downloaded from *www.steel-stainless.org/uksoftware* or from *www.steelbiz.org*. Paper copies may be ordered from Steelbiz or directly from SCI.

Architects' Guide to Stainless Steel
This SCI publication (P179) provides technical information and includes a number of case studies. A paper copy may be ordered through Steelbiz or directly from SCI. Alternatively, a web site of the publication, with additional case studies, is available at *www.steel-stainless.org/architects*

Design software for stainless steel
Design software for stainless steel structural sections to the Eurocodes is available from *www.steel-stainless.org/software*. The software includes fire resistant design and refers to a database of hot rolled and laser welded sections as well as enabling the user to define the dimensions of a range of cold formed sections. Design software in accordance with British Standards is available at *www.steel-stainless.org/uksoftware*.

Online Information Centre for Stainless Steel in Construction
This on-line database contains over 100 resources concerning the design, specification, fabrication and installation of stainless steel in construction. Information may be accessed from *www.stainlessconstruction.com*.

Stainless SteelCAL
SteelCAL provides computer aided learning modules for students and young practising engineers and architects. The modules are available in English, Portuguese and Spanish. The modules may be accessed through *www.steel-stainless.org/steelcal*.

Information & Guidance on the Use of Stainless Steel in the Water Industry
Guidance on grade selection, durability, design, fabrication and maintenance for water industry applications may be downloaded from *www.stainlessconstruction.com/Specification/General*

Euro Inox

Euro Inox is the European market development association for stainless steel and its web site *www.euro-inox.org* provides extensive guidance on the use of stainless steel, including some of the above mentioned documents. Further relevant publications are:

Erection and Installation of Stainless Steel Structural Components
This Euro Inox publication (which was drafted by SCI) provides guidance on site practice for stainless steel construction. The publication may be downloaded from the web site or a paper copy may be ordered from that site.

Stainless Steel in Contact with Other Metallic Materials. Materials and application Series, Volume 10
This Euro Inox publication (latest issue, 2009) describes the principles of galvanic corrosion and the main parameters that allow designers to estimate corrosion risk.

Other resources

Electronic advisory
The British Stainless Steel Association provides a web-based advisory service on all aspects of stainless steel. It may be accessed at *www.bssa.org.uk*

In addition to these resources, designers should be aware that two new European specifications were issued in May 2009, covering stainless steel in construction:

BS EN 10088-4:2009 Stainless steels. Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for construction purposes

BS EN 10088-5: 2009 Stainless steels. Technical delivery conditions for bars, rods, wire, sections and bright products of corrosion resisting steels for construction purposes

Contact: Nancy Baddoo
Tel: 01344 636525
Email: advisory@steel-sci.com

New and Revised Codes & Standards

(from BSI Updates September 2009)

BRITISH STANDARDS

NA to BS EN 1991:-
UK National Annex to Eurocode 1. Actions on structures
NA to BS EN 1991-3:2006
Actions induced by cranes and machinery
No current standard is superseded

NA to BS EN 1993:-
UK National Annex to Eurocode 3. Design of steel structures
NA to BS EN 1993-5:2007
Piling
No current standard is superseded

BS EN PUBLICATIONS

BS EN 1090:-
Execution of steel structures and aluminium structures
BS EN 1090-1:2009
Requirements for conformity assessment of structural components
No current standard is superseded

BS EN 10225:2009
Weldable structural steels for fixed offshore structures. Technical delivery conditions
Supersedes BS EN 10225:2001
BS EN 14399:-
High-strength structural bolting assemblies for preloading

BS EN 14399-9:2009
System HR or HV. Direct tension indicators for bolt and nut assemblies
Supersedes BS 7644-1:1993 and BS 7644-2:1993 which are declared obsolescent
BS EN 14399-10:2009
System HRC. Bolt and nut assemblies with calibrated preload
Supersedes BS 4395-1:1969 and BS 4395-2:1969 which remain current

PUBLISHED DOCUMENTS

PD 6698:2009
Recommendations for the design of structures for earthquake resistance to BS EN 1998
No current standard is superseded

BRITISH STANDARDS PROPOSED FOR CONFIRMATION

BS 7668:2004
Weldable structural steels. Hot finished structural hollow sections in weather resistant steels. Specification

BRITISH STANDARDS WITHDRAWN

BS 5531:1988
Code of practice for safety in erecting structural frames
This standard has been withdrawn as it is no longer relevant

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT – NATIONAL BRITISH STANDARDS

09/30128164 DC
NA to BS EN 1993-6 UK National Annex to Eurocode 3. Design of steel structures. Part 6. Crane supporting structures

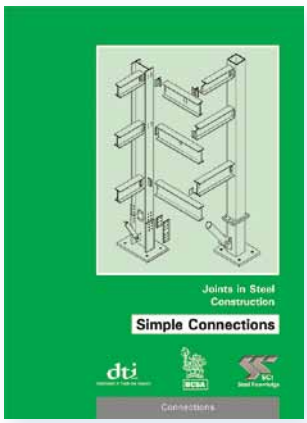
CEN EUROPEAN STANDARDS

EN 1991:-
Eurocode 1. Actions on structures
EN 1991-1-4:-
General actions. Wind actions
CORRIGENDUM 1: July 2009 to EN 1991-1-4:2005

EN 1993:-
Eurocode 3. Design of steel structures
EN 1993-1-8:-
Design of joints
CORRIGENDUM 2: July 2009 to EN 1993-1-8:2005
EN 1993-2:-
Steel bridges
CORRIGENDUM 1: July 2009 to EN 1993-2:2006
EN 1993-4-2:-
Tanks
CORRIGENDUM 1: July 2009 to EN 1993-4-2:2007

Publications

The 'Green Book' is available both from SCI and BCSA
SCI: Tel: Direct 01344 636505 Fax: 01344 636570 email: publications@steel-sci.com website: www.shop.steelbiz.org
BCSA: Tel: 020 7839 8566 Fax: 020 7976 1634 email: don.thornicroft@steelconstruction.org



Catalogue Reference: P212
Editors; E Hole, A Malik and A Way
ISBN 978-1-85942-072-0,
498 pp, A4, paperback,
September 2009

Joints in steel construction: Simple Connections

(Reprinted Edition)

'The Green Book' is in stock again.

The Green book has become widely accepted as an industry standard for a range of simple connection design. Comprehensive step-by-step design procedures, worked examples and capacity tables are included for double angle cleats, flexible end plates, fin plates, splices, and column base plate connections. Capacity tables have an extensive range of standard connections with shear and tying capacities tabulated in user-friendly format.

The **reprinted edition**, includes amended capacity tables for fin plates based on Corrigenda 1 and 2 included with the first impression.

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OFFER PRICES:
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Steelwork contractors for buildings

BCSA is the national organisation for the steel construction industry.
Membership of BCSA is open to any Steelwork Contractor who has a fabrication facility within the United Kingdom or Republic of Ireland.
Details of BCSA membership and services can be obtained from
Gillian Mitchell MBE, Deputy 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 £1,400,000
ACL Structures Ltd	01258 456051			●	●		●				●						Up to £3,000,000
Adey Steel Ltd	01509 556677				●	●	●	●		●	●			●	●		Up to £3,000,000
Adstone Construction Ltd	01905 794561			●	●	●											Up to £4,000,000
Advanced Fabrications Poyle Ltd	01753 531116				●		●	●	●	●	●				●	✓	Up to £800,000
Andrew Mannion Structural Engineers Ltd	00 353 90 644 8300		●	●	●	●	●	●			●	●		●		✓	Up to £6,000,000
Angle Ring Company Ltd	0121 557 7241												●				Up to £800,000
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 8954 0028				●					●	●			●	●	✓	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
AWF Steel Ltd	01236 457960				●				●	●	●			●	●		Up to £100,000
B D Structures Ltd	01942 817770			●	●	●	●				●			●			Up to £1,400,000
Ballykine Structural Engineers Ltd	028 9756 2560			●	●	●	●	●				●				✓	Up to £2,000,000
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
Bone Steel Ltd	01698 375000	●	●	●	●	●	●			●	●	●		●		✓	Up to £6,000,000*
Border Steelwork Structures Ltd	01228 548744			●	●	●	●			●	●				●		Up to £3,000,000
Bourne Construction Engineering Ltd	01202 746666		●	●	●	●	●	●	●	●	●	●	●	●		✓	Above £6,000,000
Browne Structures Ltd	01283 212720				●			●							●		Up to £400,000
BSB Structural Ltd	01506 840937			●	●	●									●		Up to £800,000
Cairnhill Structures Ltd	01236 449393				●	●	●	●		●	●			●	●	✓	Up to £1,400,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●			●	●		●		✓	Up to £6,000,000
Chieftain Contracts Ltd	01324 812911			●	●										●		Up to £400,000
Cleveland Bridge UK Ltd	01325 502277	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000*
CMF Ltd	020 8844 0940				●		●	●		●	●				●		Up to £6,000,000
Compass Engineering Ltd	01226 298388			●	●		●		●								Up to £2,000,000
Conder Structures Ltd	01283 545377		●	●	●	●	●				●	●		●	●	✓	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
Cronin Buckley Fabrication & Construction Ltd	00 353 21 487 0017			●	●	●	●				●						Up to £6,000,000
Crown Structural Engineering Ltd	01623 490555			●	●	●	●		●		●			●	●	✓	Up to £1,400,000
D A Green & Sons Ltd	01406 370585		●	●	●	●	●	●	●	●	●	●		●	●	✓	Up to £6,000,000
D H Structures Ltd	01785 246269				●						●						Up to £200,000
Deconsys Technology Ltd	01274 521700				●					●				●	●		Up to £200,000
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
Emmett Fabrications Ltd	01274 597484			●	●	●	●							●			Up to £1,400,000
EvadX Ltd	01745 336413			●	●	●	●	●	●	●	●	●				✓	Up to £3,000,000
F J Booth & Partners Ltd	01642 241581			●	●		●				●				●	✓	Up to £4,000,000
Fairfield-Mabey Ltd	01291 623801	●	●	●	●	●	●	●	●	●	●	●		●		✓	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)**

Company name	Tel	C	D	E	F	G	H	J	K	L	M	N	Q	R	S	QM	Contract Value (1)
Fisher Engineering Ltd	028 6638 8521		●	●	●	●	●	●	●	●	●	●				✓	Above £6,000,000
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●			●						Up to £3,000,000
Frank H Dale Ltd	01568 612212		●	●	●	●										✓	Up to £6,000,000
Gibbs Engineering Ltd	01278 455253				●		●	●		●	●				●	✓	Up to £200,000
GME Structures Ltd	01939 233023			●	●		●	●		●	●			●	●		Up to £800,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●			Up to £1,400,000
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 £4,000,000
H Young Structures Ltd	01953 601881			●	●	●	●	●			●						Up to £2,000,000
Had Fab Ltd	01875 611711								●		●				●	✓	Up to £1,400,000
Hambleton Steel Ltd	01748 810598		●	●	●	●	●	●				●		●		✓	Up to £6,000,000
Harry Marsh (Engineers) Ltd	0191 510 9797			●	●	●	●				●	●					Up to £2,000,000
Harry Peers Steelwork Ltd	01204 558500			●	●	●	●	●	●	●	●			●		✓	Up to £4,000,000
Henry Smith (Constructional Engineers) Ltd	01606 592121			●	●	●	●	●									Up to £6,000,000
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●		Up to £4,000,000
Hills of Shoeburyness Ltd	01702 296321									●	●				●		Up to £800,000
J Robertson & Co Ltd	01255 672855									●	●				●		Up to £200,000
James Bros (Hamworthy) Ltd	01202 673815			●	●		●			●	●	●			●	✓	Up to £2,000,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●					●		●			Up to £6,000,000*
John Reid & Sons (Strucsteel) Ltd	01202 483333		●	●	●	●	●	●	●	●	●	●		●			Up to £6,000,000
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●						Up to £1,400,000
Leonard Cooper Ltd	0113 270 5441				●		●		●		●			●			Up to £1,400,000
Leonard Engineering (Ballybay) Ltd	00 353 42 974 1099			●	●	●	●				●						Up to £3,000,000
Lowe Engineering (Midland) Ltd	01889 563244									●					●	✓	Up to £800,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●				●	✓	Up to £3,000,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●		Up to £1,400,000
Maldon Marine Ltd	01621 859000				●			●	●	●					●		Up to £1,400,000
Midland Steel Structures Ltd	024 7644 5584			●	●	●	●										Up to £2,000,000
Mifflin Construction Ltd	01568 613311		●	●	●	●	●				●						Up to £4,000,000
Milltown Engineering Ltd	00 353 59 972 7119			●	●	●	●	●									Up to £6,000,000
Newbridge Engineering Ltd	01429 866722			●	●	●	●									✓	Up to £1,400,000
Newton Fabrications Ltd	01292 269135			●	●	●				●	●	●			●	✓	Up to £4,000,000
On Site Services (Gravesend) Ltd	01474 321552				●		●	●		●	●				●		Up to £400,000
Overdale Construction Services Ltd	01656 729229			●	●		●	●			●				●		Up to £800,000
Paddy Wall & Sons	00 353 51 420 515			●	●	●	●	●	●	●	●					✓	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
Remnant Engineering Ltd	01564 841160				●		●	●		●					●	✓	Up to £400,000*
Rippin Ltd	01383 518610			●	●	●	●	●									Up to £2,000,000
Roberts Engineering	01482 838240				●					●				●	●		Up to £100,000
Robinson Construction	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 £3,000,000
Selwyn Construction Engineering Ltd	0151 678 0236									●	●				●	✓	Up to £200,000
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 £2,000,000
South Durham Structures Ltd	01388 777350			●	●	●				●	●	●			●		Up to £800,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●				●	●			●		Up to £400,000
Terence McCormack Ltd	028 3026 2261			●	●		●	●								✓	Up to £800,000
The AA Group Ltd	01695 50123			●	●	●	●			●	●				●		Up to £4,000,000
The Steel People Ltd	01622 715900				●					●					●		Up to £100,000
Traditional Structures Ltd	01922 414172		●	●	●	●	●	●	●		●	●		●		✓	Up to £4,000,000*
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)**

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		●							
Advanced Steel Services Ltd	01772 259822								●	
Albion Sections Ltd	0121 553 1877	●								
Alternative Steel Co Ltd	01942 610601								●	
Andrews Fasteners Ltd	0113 246 9992									●
Arcelor Mittal Distribution Solutions UK – Bristol	01454 311442								●	
Arcelor Mittal Distribution Solutions UK – Wales	01443 812181								●	
Arcelor Mittal Distribution Solutions UK – Warrington	01925 817000								●	
Arcelor Mittal Distribution Solutions UK – Scunthorpe	01724 810810								●	
Arro-Cad Ltd	01283 558206			●						
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 Services Ltd	01274 682281								●	
Bentley Systems (UK) Ltd	0141 353 5168		●							
Cellbeam Ltd	01937 840600	●								
Cellshield Ltd	01937 840600							●		
CMC (UK) Ltd	029 2089 5260							●		
Combisafe International Ltd	01604 660600							●		
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									●
Corus	01724 404040				●					
Corus Bristol	01454 315314								●	
Corus Dartford	01322 227272								●	
Corus Ireland Service Centre	028 9266 0747								●	
Corus Newcastle	0191 414 2121								●	
Corus Panels & Profiles	01684 856600	●								
Corus Service Centre Dublin	00 353 1 405 0300								●	
Corus Tubes	01536 402121				●					
Corus Wednesfield	01902 484100								●	
Daver Steels Ltd	0114 261 1999	●								
Company name	**Tel**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**

Company name	Tel	1	2	3	4	5	6	7	8	9
Development Design Detailing Services Ltd	01204 396606			●						
Easi-edge Ltd	01777 870901							●		
Fabsec Ltd	0845 094 2530	●								
Ficep (UK) Ltd	01924 223530					●				
FLI Structures	01452 722260	●								
Forward Protective Coatings Ltd	01623 748323						●			
GWS Engineering & Industrial Supplies Ltd	00 353 21 4875 878									●
Hempel UK Ltd	01633 874024						●			
Hi-Span Ltd	01953 603081	●								
Industrial Shotblast & Spraying Ltd	0845 130 6715						●			
International Paint Ltd	0191 469 6111						●			
Interpipe UK Ltd	0845 226 7007								●	
Jack Tighe Ltd	01302 880360						●			
Kaltenbach Ltd	01234 213201					●				
Kingspan Structural Products	01944 712000	●								
LaserTUBE Cutting	0121 601 5000								●	
Leighs Paints	01204 521771						●			
Lindapter International	01274 521444									●
Metsec plc	0121 601 6000	●								
MSW (UK) Ltd	01355 232266	●								
MSW Structural Floor Systems	0115 946 2316	●								
National Tube Stockholders Ltd	01845 577440								●	
Northern Steel Decking Ltd	01909 550054	●								
Northern Steel Decking Scotland Ltd	01505 328830	●								
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	●								
Profast (Group) Ltd	00 353 1 456 6666									●
Rainham Steel Co Ltd	01708 522311								●	
Richard Lees Steel Decking Ltd	01335 300999	●								
Rösler UK	0151 482 0444					●				
Schöck Ltd	0845 241 3390	●								
Site Coat Services Ltd	01476 577473						●			
Steel Projects UK Ltd	0113 253 2171		●							
Steelstock (Burton-on-Trent) Ltd	01283 226161								●	
Structural Metal Decks Ltd	01202 718898	●								
Structural Sections Ltd	0121 555 1342	●								
Struthers & Carter Ltd	01482 795171								●	
Studwelders Ltd	01291 626048	●								
Tekla (UK) Ltd	0113 307 1200		●							
Tension Control Bolts Ltd	01948 667700									●
Trailerpal Ltd	01743 446666							●		
Voortman UK Ltd	01827 63300					●				
Wedge Group Galvanizing Ltd	01909 486384						●			
Wells Protective Coatings Ltd	01302 733611						●			
Company name	**Tel**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**

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

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
- **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	FG	PG	TW	BA	CM	MB	RF	QM	Contract Value (1)
'N' Class Fabrication Ltd	01733 558989	●	●	●	●		●	●	✓	Up to £800,000 *Operating under CVA*
Briton Fabricators Ltd*	0115 963 2901	●	●	●	●	●	●	●	✓	Up to £3,000,000
Cimolai Spa	01223 350876	●	●	●	●	●	●		✓	Above £6,000,000
Cleveland Bridge UK Ltd*	01325 502277	●	●	●	●	●	●	●	✓	Above £6,000,000*
Concrete & Timber Services Ltd	01484 606416	●	●	●		●	●		✓	Up to £800,000
Fairfield-Mabey Ltd*	01291 623801	●	●	●	●	●	●	●	✓	Above £6,000,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456	●	●	●	●	●		●	✓	Up to £6,000,000
Interserve Project Services Ltd	0121 344 4888							●	✓	Above £6,000,000
Interserve Project Services Ltd	020 8311 5500	●	●	●	●		●	●	✓	Up to £400,000*
Nusteel Structures Ltd*	01303 268112	●	●	●	●	●		●	✓	Up to £4,000,000*
P C Richardson & Co (Middlesbrough) Ltd	01642 714791	●						●	✓	Up to £3,000,000*
Remnant Engineering Ltd*	01564 841160	●							✓	Up to £400,000*
Rowecord Engineering Ltd*	01633 250511	●	●	●	●	●	●	●	✓	Above £6,000,000
TEMA Engineering Ltd	029 2034 4556	●	●	●	●	●	●	●	✓	Up to £1,400,000*
Varley & Gulliver Ltd	0121 773 2441		●					●	✓	Above £2,000,000
Watson Steel Structures Ltd*	01204 699999	●	●	●	●	●	●	●	✓	Above £6,000,000

* Denotes membership of the BCSA

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right down to the nuts and bolts!

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