www.new-steel-construction.com

NSC

Velodrome is an Olympic first

Vol 18 No. 10 Nov/Dec 2010

New technology in Coventry

Plymouth centres on sports

Reusing structural steelwork

University research laboratory

Final call for entries

celebrating excellence in steel

Final call for entries for the 2011 Structural Steel Design Awards

Tata Steel and The British Constructional Steelwork Association have pleasure in inviting entries for the 2011 Structural Steel Design Awards.

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

The Awards are open to steel based structures situated in the United Kingdom or overseas that have been built by UK or Irish steelwork contractors using steel predominantly sourced from Tata Steel. They must have been completed and be ready for occupation or use during the calendar years 2009-2010; previous entries are not eligible.

To find out more and request an entry form visit:
www.steelconstruction.org
or call Gillian Mitchell of BCSA on 020 7747 8121

Closing date for entries:
Friday 3rd December 2010

BCSA

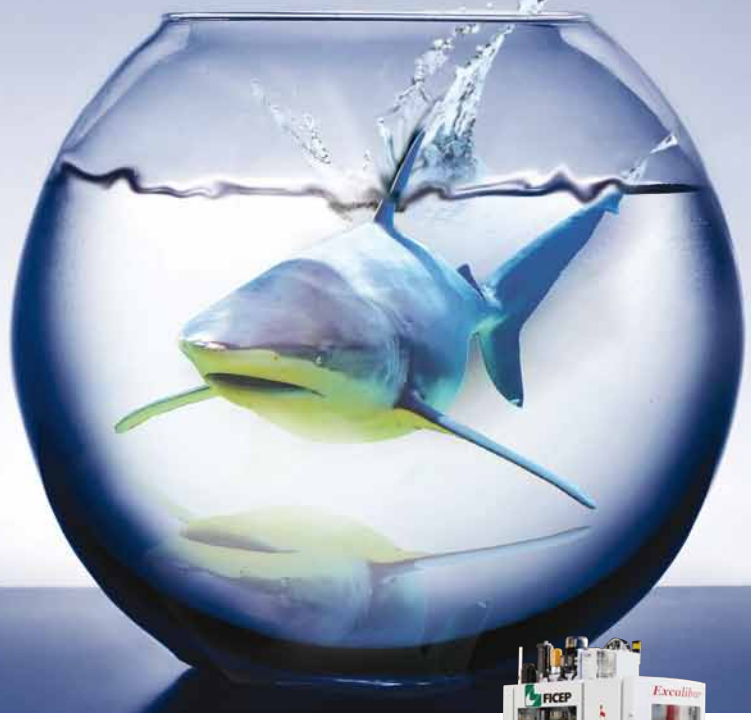
TATA STEEL

Cover Image
Manufacturing Technology Centre, Coventry
Main Client: MTC Ltd, Advantage West Midlands
Architect: Fairhurst Design Group
Steelwork contractor: Caunton Engineering
Steel tonnage: 1,000t

November/December 2010 Vol 18 No 10

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

Much smaller yet still incredibly powerful



FICEP has combined many of the features with the fast and more powerful performance of much larger and far more expensive steel processing machinery to create a new range of small footprint, high output CNC steel processing machines - making them ideal for small to medium, steel fabricators and steel processing companies.

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THE COMPLETE SOLUTION FOR FABRICATION AND STEEL CONSTRUCTION

Competitive advantage on the rise

Nick Barrett - Editor

Full economic recovery might yet be some way off, but there are encouraging signs from some markets at least that it might be sooner rather than later. The steel sector has been advising clients for many months that it is time to act to catch prices at anything like the bottom of the cycle.

Major developers have been among the first to heed this advice and we have already seen the start of previously stalled large commercial developments in London, for example British Land's 47 storeys Leadenhall building.

Steel frames will dominate this new round of multi storey building, in the City, the West End and Docklands mostly, as well as whatever other multi storey development might get under way throughout the UK in the coming years. Why? The answers can be gleaned from the Cost Comparison Study news story and the pamphlet that is included with this issue of NSC.

The competitive price gap between steel and concrete multi storey framing solutions has been heavily in favour of steel for many years and according to this year's study the gap is at its biggest ever and is growing.

This success derives from the steel sector consistently making productivity enhancing investments across its activities from steelworks to fabrication workshops and to site, that have been shared with clients, which has given steel a 70% market share of multi storey buildings.

Not all construction markets have great hopes of increased workloads over the next few years. One of the major props to industry demand during the recession has been the schools building programme, and a large number of first class school buildings were provided under the Building Schools for the Future programme. This has now been halted and an alternative procurement means is being sought.

Schools will still be built but the clients will focus more closely than ever on value for money. With its proven cost and sustainability advantages steel can expect to improve market share in any sector where the focus on those factors is increased.

Even though the steel sector has been hit hard by the recession and a handful of well known names have gone out of business, research projects aimed at making steel even easier to design and construct with are still being funded by the steel sector. Among these has been research slaying the myth that heavy concrete frames deliver any sustainability benefits because of thermal mass, as standard steel construction provides the thermal mass required for passive cooling.

Further proof of this can be seen in this month's News, the release of the latest in the Target Zero series of design guides that support the government's ambitious carbon reduction targets. This new guide supports the pursuit of low carbon targets in the retail sector. It arms designers with all they need to know to use steel with its many sustainability advantages in the achievement of low carbon goals.

Much remains uncertain about the pace of economic recovery but we can be sure about a few things; long after the recession and the public sector spending cuts are forgotten, sustainability will still be topping corporate and government agendas – and steel will still be top choice as a framing solution.

NSC

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The competitive gap widens

The cost gap between steel and concrete as framing materials is bigger than it has ever been, according to the latest in the independently produced Cost Comparison study series. Steel frames have consistently been proven to be faster to build and more cost effective than reinforced concrete alternatives since the series started in 1993.

The cost differential between the average steel and concrete options is actually wider now than it was in 1995 when the steel options were £12.10/m² cheaper - they are now £47.55/m² cheaper. The latest survey, using second quarter 2010 figures, shows the concrete frame and floor options cost an average of £160.36/m² compared to the average steel cost of only £112.81/m².

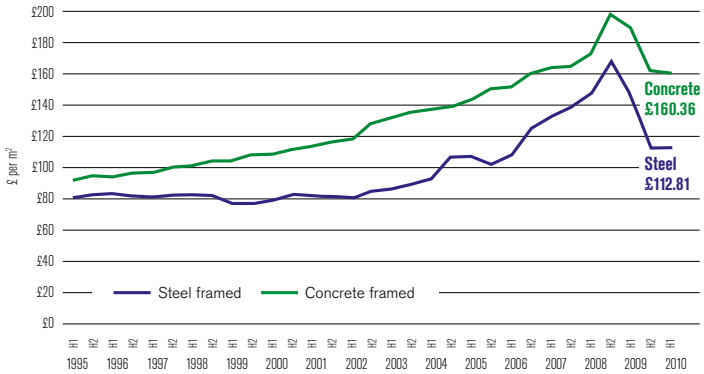
The independently produced cost comparison study for commercial buildings includes costings, structural design and programming by a team comprising Davis Langdon, Arup and MACE respectively.

The study considers two typical modern commercial developments, Building A which is a 2,600 square metre office in Manchester, and Building B which represents a prestige office building of 18,000 m² in London. developments.

The Department for Business, Innovation and Skills produces monthly statistics tracking material costs against GDP inflation, allowing real terms comparison to be made. They show that since 1995 the cost of steel has increased by 16%, the cost of concrete has increased by 20% and reinforcement bar has increased by 53%.

Alan Todd, BCSA Marketing Development Director, said: "This annual cost comparison study has consistently shown that steel is more cost effective than concrete as a framing solution. That fact is reflected in the annual survey of market shares, which confirms steel is the choice for 70% of the UK's multi storey building frames."

Full details on *www.steelconstruction.org/compare*



Comparison of steel and concrete frame costs, Buildings A & B – average of all schemes

Media City bridge slid into place

An £8.3M state of the art cable stayed swing bridge, linking Trafford Quays with the Media City development in Salford, has been slid into position by main contractor Balfour Beatty Regional Civil Engineering.

Spanning the Manchester Ship Canal, the 880t steel footbridge was assembled by steelwork contractor Rowecord Engineering on an adjacent quay, and once completed it was slid 50m into its final pivot position.

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

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

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

Outstanding first for More London

The final piece in the More London office development, Plot 7, has been awarded BREEAM 'Outstanding', making it the first building in London and the first major office in the UK to achieve this rating.

The recently completed More London 7 was initially designed to achieve a BREEAM 'Excellent' rating, but it has exceeded all of the design team's expectations.

Designed by Foster & Partners, the building is the first commercial structure in London with its own bio diesel combined cooling, heating and power plant. This system heats the building and uses waste heat to power refrigeration when cooling is required.

The office interiors are heated and cooled by radiance systems using natural air convection, which results in a fresher and healthier interior environment. It has been calculated that More London 7 emits 55% less carbon than a building built to normal building regulations.

More than 5,000t of structural steelwork was erected by Severfield-Reeve Structures for this project.

Targeting retail savings

The third of the five Target Zero guides, covering retail buildings, will be published shortly and available for download in pdf format at www.targetzero.info

The Target Zero Retail Guidance provides invaluable information for designers, construction clients and their professional advisors on how to design and construct sustainable and cost effective retail structures.

Target Zero is a steel construction sector project designed to provide guidance on the design and construction of sustainable, low and zero carbon buildings.

Five non-domestic building types are being analysed in the project funded by Tata Steel and the BCSA. Guides on secondary schools and distribution warehouses have already been published.

Two more building types - medium to high rise offices and mixed-use buildings - are being analysed, and these guides are also due to be published in the new year.

To log your interest in receiving notification of when the guides become available, visit *www.targetzero.info*

Curved roofs form new Corby school

Steelwork has been completed on the £14M Maplefields School project in Corby, Northamptonshire.

Working on behalf of main contractor Graham Construction, Walter Watson erected 300t of structural steelwork for the project, which incorporates a number of environmental features into an eye-catching design.

Consisting of two one-storey buildings, both structures feature wavelike rolling roofs, which will be topped with green sedum. Other eco-friendly features include rainwater harvesting, high levels of thermal insulation, natural ventilation and solar thermal panels.

"The geometry of the roof was a complete series of curves fabricated from a combination of beams, cellular beams, hollow sections and channels," said Trevor Irvine Walter, Watson's General Manager Structural Division.

"There were a number of S curves on the job, some of which Angle Ring were able to curve in one piece and some of which had to be curved in two sections and then joined to form the S curve. There were over 360 individual curved members on this job."

Maplefields School is due to open in autumn 2011.

Steel projects triumph at industry awards

Glasgow's New Stobhill Hospital scooped the prestigious Prime Minister's Better Public Building Award at the British Construction Industry Awards 2010.

Working on behalf of main contractor Balfour Beatty Construction, Severfield-Reeve Structures erected 1,600t of structural steelwork for the project.

Commenting on the completed hospital, the judges said: "New Stobhill has brought dignity to civic design and delivery and has exceeded the client's aspirations. There is an incredibly high level of design and it is built to a very high standard."

With a total floorspace of 30,000m^2, the hospital provides 2,000 patients with a modern healthcare facility which was delivered on time and to the £65M budget.

Ropemaker Place, London, another high profile steel framed sturcture, won the Major Project Award. This is a new 21 storey office block providing highly energy efficient and flexible space on a congested city centre site.

Severfield-Reeve Structures erected more than 5,000t of structural steelwork for this project.

The Civil Engineering Project Award went to the A40 Bridges Replacement project. This job included the construction of a new steel footbridge to span the busy dual carriageway. Steelwork contractor for this project was SH Structures.

AROUND THE PRESS

Construction News
14 October 2010
Leaning city library tears up the rulebook
(Canada Water library) When complete, the entire building will be held together by a steel roof, which will act like a drum skin and brace the entire structure.

The Structural Engineer
5 October 2010
Design for durable structural steelwork in New Zealand
Steel is one of the most sustainable materials on Earth. It is 100% reusable, recyclable, easy to use and maintain. To complement the numerous benefits of steel and extend its life, suitable protective measures must be taken to ensure structural performance is not reduced over its design life.

The Financial Times
9 October 2010
Olympic benefits spread across UK
(Letter from Olympic Delivery Authority Chairman John Armitt) The main construction contract for the Olympic Stadium is with Sir Robert McAlpine, the multimillion pound subcontract for the fabrication of steel was awarded to Watsons, a company based in the north-west. Likewise, the main contract for the aquatic centre is with Balfour Beatty, but the subcontract for the steel, which is not included in the figures published, is with Rowecord in Wales, and is another multimillion pound contract.

Building Magazine
8 October 2010
Gilt trip
(Savoy Hotel refurbishment) The riverside suites now have great views over the Thames. This involved getting rid of the bathrooms sandwiched between the original façade and another added in 1910, which is suspended from huge red beams. The original façade supported these beams, which necessitated new structural steelwork.

Steel industry leads nuclear feasibility study

The Technology Strategy Board has awarded funding for a feasibility study into the design of modular construction for nuclear facilities, with Caunton Engineering, SCI and Amec Nuclear UK forming the initial partnership.

They will investigate the design of steel concrete steel modular construction and the feasibility of producing a national and international standard for nuclear use. They will also assemble guidance that can be adopted in its present form and identify new information that must be generated.

SCI Director, Bassam Burgan said: "Steel concrete steel modular construction is primarily offsite and therefore speeds up the construction programme. It has been estimated that it could reduce the timescale for the construction of a nuclear plant from eight years to four years."

The modules would consist of two steel panels with long shear studs connecting to a concrete middle. Many of the buildings, including those housing the reactor, could be constructed using this method. The modules could be of various sizes, but one of the objectives is to investigate the feasibility of supplying sub-assemblies by a medium sized steelwork contractor.

Representing steelwork contractors, Caunton Engineering is the leader of the exercise. "We will give the study an industrial viewpoint and advise on what is practical and how to produce cost efficiently," summed up Caunton Engineering Managing Director Simon Bingham.

Access boost for Stratford and Olympic sites

The new Angel Lane steel composite replacement bridge has created improved road, walking and cycling links in Stratford town centre and into the Olympic Park.

The bridge spans railway lines near Stratford Station and has replaced an old Victorian structure which had weight restrictions and poor sight lines for vehicles.

Steelwork contractor Mabey Bridge erected the 400t structure in five braced pairs of girders, each lifted into place with ductwork already affixed to the steel.

Olympic Delivery Authority Director of Infrastructure and Utilities Simon Wright said: 'The opening of the new Angel Lane bridge will deliver improved links for cyclists, pedestrians and motorists and help unlock the area for transport enhancements to benefit local people before, during and long-after the Games. The construction of the new bridge was a huge engineering challenge carried out in a constrained railway environment, so to deliver these works on time is a significant milestone.'

Steel framed headquarters celebrates 100 years

The headquarters of the Institution of Civil Engineers (ICE), One Great George Street, celebrated its centennial anniversary during October.

Designed by architect James Miller, One Great George Street was one of the first steel-framed buildings (not long after The Ritz hotel in 1905) to be built in London. The construction programme lasted from 1910 to 1913 and followed a change in building regulations in 1909, which permitted the use of steel framing for the first time without the need for use of load bearing external walls.

The general contractor for the project was Mowlem and the steelwork contractor was Dawnays of Battersea. Established in 1870, Dawnays was a leading structural engineering firm and was responsible for the design, supply and erection of numerous steel-framed structures in the UK and overseas.

Top quality materials were used in the construction of the ICE HQ including the use of Portland Stone in the entrance and on the facade, as well as the use of oak and walnut which make up the panelling in the ground floor meeting rooms.

Many significant historic events have taken place at the venue

including the signing of the charter establishing UNESCO in 1945 as well as the G7 summit.

One Great George Street was recently selected by the Mayor of London as the London Media Centre for the 2012 Olympic Games.

BCSA addresses EU Parliament on CE Marking

BCSA Director of Engineering Dr David Moore has addressed a hearing of the Committee on the Internal Market and Consumer Protection (IMCO) at the European Parliament in Brussels about the implementation of CE Marking.

Dr Moore was invited to speak by Ms Catherine Stihler MEP and Reporter for IMCO. He spoke about the Construction Products Regulations (CPR) on behalf of the constructional steelwork industry, stressing the need for a regulatory level playing field. Other topics in his address included the need for policing of CE Marking and sustainability, in particular the recyclability of steel.

"The address was well received by the MEPs, parliamentary officials and representatives from the European Commission, while the subsequent discussion addressed some of the issues raised," commented Dr Moore.

Ms Stihler said that policing of CE Marking was a concern shared by other committees particularly in the light of the spending reductions being implemented by national governments.

Members of IMCO will review the evidence and propose amendments to the CPR prior to voting on the text at the Second Reading.

"Assuming the Second Reading goes smoothly, the CPR will be adopted in spring 2011 and CE Marking will become mandatory in all member states in mid 2013," said Dr Moore.

SCI assessed awarded to deck properties

Structural properties of the TR60+ and TR80+ profiled steel sheeting products from Structural Metal Decks (SMD) are the latest addition to the list of products and data that have received SCI Assessed status.

Structural properties important for the design and specification of composite floor decking have been assessed for sheeting manufactured in 0.9mm, 1.0mm and 1.2 mm thicknesses and S350 and S450 grades of galvanized steel.

The assessment included the analysis of tests on profiled steel sheeting performed on behalf of SMD at the University of Southampton, and the subsequent derivation of characteristic properties for use in design. The two profiles included, TR60+ and TR80+, are trapezoidal profiles with a shoulder height of 60mm and 80mm respectively.

Characteristic values were determined for the design properties that define the spanning capabilities of the profiles at both the construction and normal stage, namely: sagging and hogging bending resistances; sagging and hogging second moment of areas; web-crushing resistance; and composite bond performance.

In addition to the characteristic values, test data from two-span continuous tests were analysed to determine the performance of the profiles over the support, specifically the amount of moment redistribution possible, the failure mechanisms over the support and the relationship between the hogging second moment of area and the applied shear. These relationships can be used in design using the SCI Improved Engineering Method.

Demountable steel opera pavilion gets go ahead

The new home for the renowned Garsington Opera festival will be a demountable steel pavilion at the Wormsley Estate, the Buckinghamshire home of the Getty family.

The pavilion will be erected and demounted each year for the opera season, and will be made from a combination of steelwork, timber and fabric.

Robin Snell, Director of Snell Associates Architects said: "The design takes its cue from a traditional Japanese pavilion in its use of sliding screens, extended platforms, verandas and bridges to link it to the landscape.

"By using the materials we've chosen, the pavilion will be a lightweight structure, erectable in three weeks and also easily demounted for storage when it's not in use."

Having just received planning permission for the structure, main contractor Unusual Rigging, the UK's most experienced provider of stage engineering and technical solutions for entertainment and sports venues, has not yet contracted any subcontractors.

Earlier this year Garsington Opera reached agreement with Mark Getty to hold the festival at the Wormsley Estate from the summer of 2011.

NEWS IN BRIEF

The last two **Steel Essentials** seminars - a series of events aimed at keeping construction professionals aware of the latest developments in steel construction - will be held in Edinburgh on 23 November, and Leeds on 8 December. For more information or to register email: *Stephanie.hughes@steelconstruction.org*

SCI has commenced work on the Eurocode version of the **Moment Connections Green Book**. The new publication will be an updated version of P207 – Joints in Steel Construction: Moment Connections and will include design rules, worked examples as well as approximate resistances that can be achieved with typical moment connection details. In addition, the Eurocode approach will be followed for moment resisting column bases. This design guide is expected to be available in 2012.

SCI has commenced work on a design guide for portal frames to the **Eurocodes**. The guide will provide designers with simple rules for preliminary design and will explain the detailed code checks carried out by software. The Eurocode is not as comprehensive as BS 5950 in its coverage of portal frames, so it is anticipated that some current practice will become Non-Contradictory Complementary Information (NCCI) for use in Eurocode design. The guide is expected in 2012.

Joe Locke, Caunton Engineering Non-Executive Director and SSDA judge has been awarded an Honorary Doctorate by the University of Bolton. Mr Locke is the former CEO of Bolton-based Watson Steel Structures and the Institution of Structural Engineers awarded him with a Gold Medal in 2007.

SCI's On-line courses are proving to be a popular alternative to full one-day public courses. The on-line courses are split into three sessions, these are interactive and completion of worked examples during the course is expected. The next step for the development of the on-line courses will be to record them for download. Providing you have a computer with sound and good internet access, why not undertake training from the office or from home and save time and money on travelling to a course.

Instructions made simple with pictures

Leading structural load bearing insulation manufacturer Schöck has developed a package of method statements that are totally pictorial.

The instructions, which are available for every product in the Schöck Isokorb range, feature the character 'Ebi', who is the company's web mascot. He carefully guides the user through the correct installation procedure on a step-by-step basis, using simple graphics.

The company said during an international customer survey it discovered that due to the number of migrant workers being employed on European construction sites, language difficulties were resulting in on-site communication problems affecting correct product installation.

Michael Currier, Managing Director for Schöck said: "The reaction has been really positive. This simple solution helps avoid basic installation errors and the efficiencies gained on so many sites can only be beneficial to both contractors and ourselves."

Balloon release celebrates Colorcoat relaunch

To celebrate the relaunch of Colorcoat Prisma, Tata Steel hosted a European wide balloon release to mark the event. Illustrating the global reach of Colorcoat Prisma, the balloons were all released at 10am GMT in six locations across the UK, as well as in six other European localities.

Congratulations went to Maes Garmon School in Flintshire, whose balloon travelled the furthest, flying a total distance of 83km to be found on a farm in Buxton, Derbyshire.

Tata Steel has donated a hot air balloon ride to the winner of the balloon release. Maes Garmon School Teacher, Emma Houston said: "It was great to take part in the balloon release. We are delighted to have won and we will auction the balloon ride to raise funds for our school."

BCSA launches CE Marked NSSS

A fully CE Marked version of the fifth edition of the National Structural Steelwork Specification (NSSS) for Building Construction was launched at BCSA's most recent national meeting.

At the meeting Dr. Roger Pope of the BCSA explained that this version is fully compliant with the new European standard for fabrication, BS EN 1090-2 and the CE Marking standard BS EN 1090-1. Furthermore this new version does not supersede the existing fifth edition of the NSSS which still remain current for those applications which do not require CE Marking.

The main changes are to Section 11 Quality Assurance which requires the steelwork contractor to have all the necessary facilities, skills, and quality management systems. In addition it stipulates that the steelwork contractor shall have a factory production control system certified by a Notified Body for compliance with BS EN 1090-1.

Other changes include simplified procedures for weld inspection and tables for weld inspection and acceptance criteria.

The references to British Standards have been updated throughout the specification.

Copies of the NSSS 5th Edition (CE Marking version) can be obtained from BCSA, price £25 inclusive of postage & packing; telephone 020 7839 8566 or email *don.thornicroft@steelconstruction.org*

SCI seeks designers feedback

SCI's publications have been a key part of its offerings for more than twenty years. In more recent times it has complimented this hard copy information with the likes of *www.steelbiz.org* and *www.access-steel.com.*

"In order to continue to effectively fulfil its role as disseminators of best practice to the steel construction sector, we must be aware of the changing face of technology, and look in to what best meets the needs of today's engineers; especially how and when you need technical information and what your preferred format is for accessing it," said Graham Couchman, SCI Chief Executive.

If you are a practicing designer the SCI would be very interested to talk to you about your preferred ways of getting technical support. It would like to gauge how you use the information and when you would typically access it.

If you are interested in participating and providing feedback, please contact James Attree or Graham Couchman at SCI, tel: 01344 636 583

Diary

For Steel Essentials contact Stephanie Hughes email: *stephanie.hughes@steelconstruction.org*

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

11 November 2010
Steel connection design
Kidderminster

16 November - 14 December 2010
"New" Practical Design to EC3 (Evening Course) London

16, 23 & 30 November 2010
"New" On-line Steel Building Design to EC3 Part 3 Internet

17 & 18 November 2010
Steel Bridge Design
London

23 November 2010
Steel Essentials
Caledonian Hotel, Edinburgh

24 & 25 November 2010
Essential Steelwork Design
Glasgow

2 December 2010
Steel Building Design to EC3
Basingstoke

8 December 2010
Steel Essentials
Thorpe Park Hotel, Leeds

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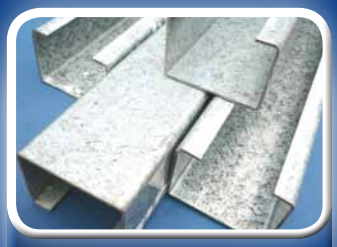

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Steel treatment for research campus

FACT FILE
Research facility, Newcastle General Hospital
Main client: Newcastle University
Architect: Devereux Architects
Main contractor: ISG
Structural engineer: Cundall
Steelwork contractor: EvadX
Steel tonnage: 300t
Project value: £7.1M

The latest structure at Newcastle's state-of-the-art medical research campus is another steel-framed building. Steel has proven to be the material of choice for the entire site's ongoing construction programme, reports NSC.

Work is being undertaken at Newcastle General Hospital to create a world class campus dedicated to health and ageing research. The project has been steadily evolving over the last few years and the latest development, the new steel framed Biomedical Research Centre building, will sit between and link into two existing steel buildings - the Henry Wellcome Biogerontology Building and the Clinical Ageing Research Unit.

According to the client - Newcastle University - the location of the new building will help foster collaborative working, promote R&D opportunities and attract commercial organisations to the site. The Biomedical Research Centre will facilitate research into the underlying biological processes of ageing and improve the understanding and diagnosis of older patients with multiple medical conditions. The building will also provide patient care facilities as well as specialist teaching accommodation, research and incubator space.

The site of the new building was previously used as a car park and once finished the structure will form the final piece of the jigsaw by completing a square of research buildings around a courtyard.

Main contractor ISG has been on site since April 2009 and as well as ripping up the asphalt car park, early works included grouting up old coal mine workings. The entire site was initially riddled with coal workings, approximately 10m below the surface. These had to be sealed up with concrete before pad foundations were installed to accept the structural steelwork for the building's frame.

"The other recently built structures on the site are all steel-framed because of the

Impression of the completed campus including the Biomedical Research Centre to the left of the image

need for a lightweight frame, this was one of the main factors in going for a steel solution again," says Stuart Isley, Cundall Project Engineer. "As well as the speed and cost of construction."

Although the new building links into other buildings, it is essentially a stand-alone structure deriving all of its own stability from internal vertical bracing.

"It abuts two existing buildings and links into them at ground and first floor levels," adds Mr Isley. "But there are movement joints separating the structures."

Steelwork's flexibility has come to the fore with the design of the grid pattern. Although the frame is predominantly based around a 5.1m × 7.2m grid, there are slight variations on this, especially for the roof top plant areas. Structurally the ground floor keeps to the grid and will eventually house consulting rooms, the upper levels will accommodate laboratories, with some of these of varying sizes, and consequently requiring a grid pattern change.

Another area where the grid pattern alters is the glazed foyer that connects the structure to the Wellcome building. The foyer is fully glazed on two sides and contains an entrance hall and reception area. Extending upwards to the full height of the structure, it imposes itself architecturally and creates a signpost into the structure.

The entire site was initially riddled with coal workings, approximately 10m below the surface.

Steelwork fabrication, supply and erection is being undertaken by EvadX, and it completed the majority of the main frame of the structure during September.

"The site is very tight and the completed structure takes up the majority of the site which made delivering steel quite challenging," comments Steve Morris, EvadX Project Manager. "We had to phase the steelwork into erectable lots and these were delivered to site in sequence. Most of the steel was then erected almost immediately as there was little or no room for lay-down or storage."

Prior to anything being delivered to site, including steelwork, ISG have to notify the client, as the adjoining buildings are all occupied and contain some sensitive equipment such as MRI scanners. Convenient time slots are then allocated for material deliveries when the aforementioned equipment is not being used.

The majority of the steelwork columns have been brought to site in full 16m lengths, with only a few - those that extend up to the rooftop plant area - requiring a splice, at third floor level. Anything longer than 16m was deemed to be too long for the tight site.

Along the internal perimeter of the structure a row of CHS columns have been erected to create a colonnade effect around the internal courtyard, which is created by the completed new building.

Within this courtyard a single storey glazed pavilion building, featuring a green sedum roof will be constructed. EvadX will erect this structure which consists of steel columns and support beams, with stainless steel bracing and glulam beams supporting the roof.

The pavilion will house a cafe and forms part of ISG's externals package which also includes seating areas around the cafe and general landscaping. ISG will also carry out a minor refurbishment across part of the adjacent ground floor of the Henry Wellcome building.

Summing up the project, which is scheduled for completion next summer, John Gittens, ISG's Regional Director, said: "The new Biomedical Research Centre represents a major investment by the University into facilities that will not only benefit students and patients, but also places Newcastle at the heart of the global developments of pioneering new treatments and research into the ageing process."

The building's steelwork is based around a regular grid pattern

The latest building will form an enclosed court-yard that will house a café

All stability is derived from vertical bracing

A row of CHS columns form a collonade along one ground floor elevation

A centre for technological excellence

Steelwork is playing a key role in the construction of the UK's first manufacturing technology centre which is taking shape on the outskirts of Coventry. Martin Cooper reports.

FACT FILE
Manufacturing Technology Centre, Coventry
Main client: MTC Ltd, Advantage West Midlands
Architect: Fairhurst Design Group
Main contractor: Morgan Sindall
Structural engineer: Waterman Group
Steelwork contractor: Caunton Engineering
Steel tonnage: 1,000t

With backing from some of the UK's leading manufacturers as well as top research and academic institutions, the Manufacturing Technology Centre (MTC) will be a unique facility helping to ensure innovation stays at the forefront of British industry.

Located at Ansty Park near Coventry, the MTC will support UK manufacturing businesses and their supply chains, to bring about major improvements in their manufacturing competitiveness. The Centre will also offer, for the first time, a bridge between academic research and commercial production, delivering tried and tested production ready solutions direct to industry.

Research will primarily focus on assembly, fabrication and joining technologies including high integrity fabrication, advanced tooling and fixturing, as well as intelligent automation. All of this work will be backed up by research into modelling and simulation.

Jerry Finch, Morgan Sindall Project Manager says: "In order to carry out this full scale research and development, a suitable structure was needed, one in which production lines and even aircraft wings could be produced in their entirety."

Each hall's frame is based around a large 12m bay grid pattern

To this end the MTC building features three large open plan halls positioned side by side. The two outer halls have spans of 27.5m, 22.5m, while the central hall is a double span frame with a 41m span. These large portal frames will house the production areas and the steelwork for each hall also has to support a large overhead crane. Crane beams, running along the top elevation of each hall, have plates welded to the top flange to assist buckling resistance.

The supporting columns for the portal framed halls are spaced at 12m centres, and this large spacing coupled with the fact that the supported overhead cranes have capacities of up to 15t, led to larger than normal steel sections being used.

Separating the production halls are internal two-storey office structures. However, these areas actually begin at first floor level, allowing the entire MTC to have an open plan ground floor running right through the structure.

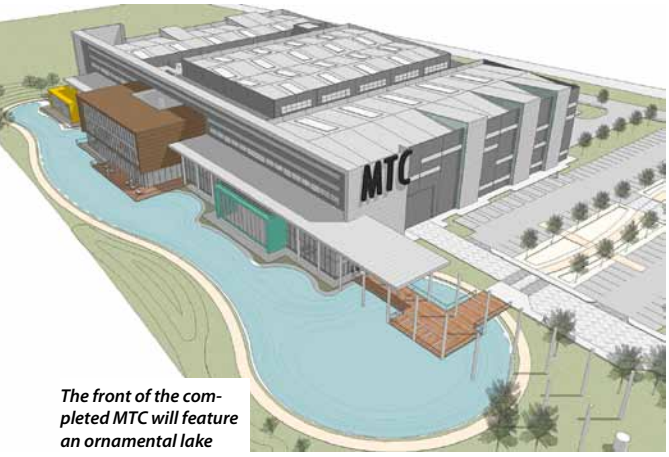
These two storey structures also had a bearing on why large 610 × 305 column sections were used. "The portal columns are not restrained along the internal elevations until the underside of the two-storey structure," explains Caunton Engineering Structural Engineer, Gavin Christie. "This was another reason why we needed large section sizes – to resist buckling of the columns."

The two-storey elements within the MTC are roughly horseshoe-shaped, running along the two inside elevations of the central hall, and then along a third elevation which is within a 'Street' sector which link the halls together, and also contains the main entrance hall and exhibition space.

As well as offices the two-storey elements will also contain technical areas such as an electronic fabrication shop along with viewing galleries overlooking the production areas. These will allow students and members of the public to see into the MTC production areas and observe the ground-breaking research development as it happens.

Connecting to the two-storey elements are a couple of mezzanine areas for plant, one of which cantilevers out by approximately 2.5m along the elevation which separates the MTC halls from the 'Street'.

Size-wise the MTC is very spacious, each of the three halls covers an area of at least



The front of the completed MTC will feature an ornamental lake

All three halls feature a large overhead crane suspended from the steelwork

one football pitch. However, flexibility played a key role in the early design of the structure and the possibility of enlarging the MTC was an important criteria.

"A number of material options were considered during the early design stages," explains Phil Spiers, Waterman Project Engineer. "A steel frame was chosen not just for its ease of construction, but also because of the ease with which services could be moved, to meet the client brief for flexibility of space, as well as the anticipated changing needs of the landlord and manufacturing tenants. This would also permit a substantial future extension to be added."

The steel frame, which was designed by Caunton Engineering under a design and build contract, has been consequently constructed to accept an extension to its eastern elevation, a structural extension which could be large enough to increase the overall footprint of the MTC by up to 25%.

With the need for large open plan areas and no cores with which to tie-into, where and how to stabilise the structure was an important issue. To this end, the MTC uses a combination of vertical bracing and portal action - mostly in staircases - to get its overall stability.

As of the end of October, Caunton had erected the majority of the steelwork with the exception of the 'Street' area. Using mobile cranes for all erection duties, the most challenging aspect as far as the company's on site team are concerned was the size of the purlins. With such large portal frames, each 12m bay required one 12m long purlin, weighing nearly one tonne. These large sections added to the steel programme, as each purlin required an individual crane lift.

The steel programme has been scheduled around other trades and the 'Street' could not be completed until internal cladding along the front elevation had been finished.

The 'Street' essentially ties the front elevation to the rest of the building. Bolted onto the front of the structure, the 9m-high frame is constructed from oval Celsius columns and a conventional steelwork canopy roof. The entire frontage will be glazed, adding an architectural finish to the building's front elevation. Either side of a two-storey sector located in the middle of the 'Street' (one part of the horseshoe structure that separates the three halls), this zone contains the main entrance and reception along with a number of exhibition areas, which will show some of the work that has been undertaken.

The reasons behind the choice of eye-catching oval sections was twofold, one for their aesthetic appeal and secondly for their aeronautical connections (the shape is supposed to conjure up images of aeroplanes) in honour of some of the MTC members.

The oval 500 × 250 sections are restrained by bracing hidden under the soffit, which allows the columns to keep their aesthetic appeal. Similarly the ovals are connected to the base and rafters by an exposed feature pin connection. Adding to the overall aesthetic look, the glazing will be positioned inside the column line, again not to interfere with the exposed oval columns. The canopy's purlins are also larger than normal, coming in at 2.5m thick, as exhibits will be hung from them.

The MTC is scheduled to open during the summer of 2011 and according to Peter Flinn, Interim Director of the MTC, research has already started with 15 to 20 programmes already lined up to occupy space at the Centre.

Each of the three halls covers an area of at least one football pitch.

Founder members of MTC Ltd are:

Rolls Royce
Jaguar Land Rover
Aero Engine Controls
Airbus UK
University of Birmingham
University of Nottingham
Loughborough University
TWI (the operating division of The Welding Institute)

The healthcare centre will be a landmark structure in Doncaster town centre

Quick steel is cost efficient

Using steel has paid dividends on a health care project in Doncaster with limited site access and storage space available.

As part of a £14M project to upgrade Doncaster's health care centres, Morgan Sindall, working on behalf of Doncaster Community Solutions, is currently constructing two new pioneering 'super surgeries'.

The largest of these is the Town Hub project, a four storey scheme which will become landmark development in the South Yorkshire town. On the site of a former Labour Club, which was demolished earlier this year, the new centre will house a GP practice, dentistry facilities, a pharmacy, a drop-in centre and community facilities for residents of Hexthorpe and Balby, as well as people working in the town centre.

Describing the project, Annette Laban, Chief Executive of NHS Doncaster, says: "We have given a commitment to the people of Doncaster that we will modernise the community buildings that are the key contact between the NHS and our patients. We are investing in the future of health care to give local people the quality of services they deserve."

With these sentiments in mind a quick and efficient construction programme was top of the agenda for the client Doncaster Community Solutions, a public private partnership involving the local NHS and Doncaster Council.

"Steel was chosen for its cost and speed of construction," explains Paul Limb, Morgan Sindall Project Manager. "The site is also quite tight and steelwork has proven to be easier to sequence around the other on-site trades."

Work began on the project in March with Morgan Sindall clearing the site of its existing buildings and in-filling an old basement with the crushed demolition material. The old basement covered approximately one third of the site's footprint and because its concrete slab and walls were so substantial (thicknesses of between 600mm to 700mm) they were retained. Pad foundations were installed on top of these walls, while piled foundations were installed around the site's perimeter, readying the site for the steelwork programme to commence.

During its four week programme steelwork contractor Hambleton Steel was also responsible for installing the building's internal precast stairs. However, due to onsite cabling works, which at one point split the entire project footprint in half, the steel erection had to be divided into two separate two week phases.

"The site is extremely tight, with roads all the way around, and little or no room for materials storage or steelwork laydown areas," comments Steve Agar, Hambleton Steel Contracts Manager.

The congested nature of the site and the lack of space meant Hambleton had to unload the majority of its steelwork from outside of the project's hoardings. Steelwork was then lifted from the delivery truck and erected almost immediately.

A lack of space and the busy surrounding streets meant the choice of a steel frame proved to be a correct decision. A concrete frame would have required more onsite equipment and more deliveries of material to a project which would have been unable to accept them.

During the first two-week steel erection phase Hambleton erected approximately 50% of the structure, using a combination of two mobile cranes. A 40 tonner was utilised for steelwork lifting, while a slightly larger 50 tonner was needed to install the precast stair units.

"We had just enough room for the two cranes," says Mr Agar. "It was slightly more difficult during the second phase as we were gradually eating up available space as the steel was erected. However, with coordination between Morgan Sindall and ourselves we overcame these problems."

Structurally the steelwork grid pattern

The front elevation will feature a steel canopy above the entrance hall

varies across the building depending on the final use of area. GP practice rooms have a smaller 4.5m grid, while larger areas, with bays up 8.7m, will accommodate group work rooms and community facilities.

The varying grid pattern dictates the structural and architectural layout as all columns are secreted within wall cavities. The only steel columns left exposed in the entire structure are CHS members in the main entrance area.

With no large cores, the structure's stability is derived from bracing, and again this is mostly hidden in wall cavities as well as in stairwells.

The Town Hub is roughly triangular in shape, with the main two-storey glazed entrance area at the front or tip of the building. This area will be topped with a canopy clad with photo voltaic louvres. Other eco friendly features include plenty of natural lighting and ventilation.

The project is scheduled for completion in autumn 2011.

FACT FILE

Town Hub primary care centre, Doncaster

Client: Doncaster Community Solutions
Architect: HDP Architects
Main contractor: Morgan Sindall
Structural engineer: MJM Consulting Engineers
Steelwork contractor: Hambleton Steel
Steel tonnage: 200t

Impression of the completed Town Hub

Steel - the never ending story

Reclaiming and reusing structural steelwork provides an environmental option unavailable with other construction materials, writes John Dowling, BCSA Sustainability Manager.

Sustainability in action on the Arup Campus in Solihull

Steel's multicycling attributes are well understood and each year up to 500 million tonnes of steel scrap are captured and returned to new uses across the world. It is also possible however, that the legacy of steel sections can be enhanced by reuse, either by recovering them from demolition sites and sending to a steelwork contractor for reuse on a new project or reusing them in full, either as an upgrade of the building or reconstructed on another site.

Using reclaimed structural steel can be an effective strategy to reduce the environmental impact of a building by eliminating the energy required to recycle scrapped steel into new structural sections.

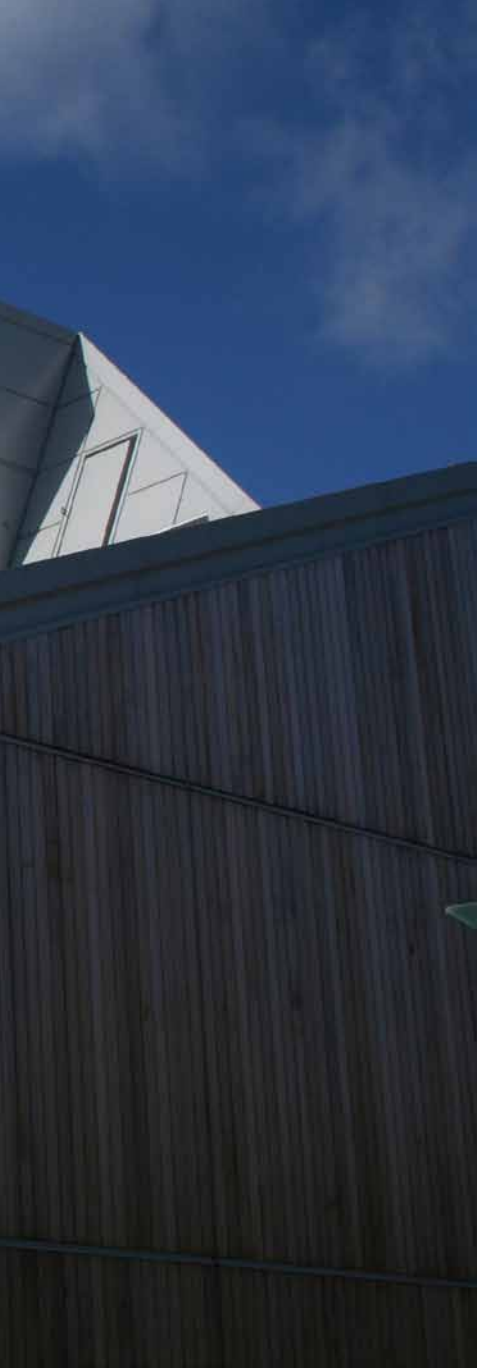
The University of Toronto Scarborough Student Centre was built using steel from the Royal Ontario Museum

Examples of reuse

There are now a significant number of examples of steel reuse in buildings. In the UK, perhaps the most widely publicised of these has been BedZed, where the Architect Bill Dunster used 98t of recovered steel. Another example of a project which successfully used reclaimed steel was the Earth Centre near Doncaster.

Additional examples can also be found abroad, in particular in Canada. The University of Toronto, Scarborough Campus Student Centre began life as part of the Royal Ontario Museum, the demolition of which provided a supply of reclaimed steel. A different type of example is the Parkwood Residences in Oshawa, where the steel frame of an existing building was used for an entirely different purpose; in this case,

1 Further information can be found at *http://www.nrcan.gc.ca/smm-mms/busi-indu/rad-rad/pdf/re-ste-fin-eng.pdf*



an abandoned office was converted into a prestige apartment building[1].

Reuse is facilitated by recovery strategies which are integrated into the buildings during the concept stage, rather than at end of life. Examples of buildings which have used this approach are the Arup Campus at Solihull, famously designed to be a "warehouse of its parts", and Prologis Park at Heathrow. See case study 1.

Prerequisites for reuse of structural sections

Those projects which have reused structural steel illustrate a number of attributes which must be brought together if steel is to be reused in the construction industry as it currently operates. Firstly, commitment is required on the part of the client and the project team. Next, it may not always be possible to find steel which exactly matches requirements and so it is necessary to have flexibility in the design, allowing for the possibility of increases in floor depth and structural weight. It is also necessary to get the timing right, in particular with regard to availability and scheduling, and coordination between demolition and construction. Finally, it must be possible to identify the structural characteristics of the salvaged steel, or at least be able to make defensible assumptions.

There are also secondary attributes which can be helpful, but are not essential. Reuse is easier if the components can be reused for a purpose similar to their original function. It also helps if the original building used similar structural layouts, spans and sizes as in the new design. In addition, steel frames which are bolted and/or non-composite facilitate dismantling.

How much steel is available for reuse?

There is a great deal of steel available in demolished buildings every year in the UK →

Case Study 1 **ProLogis Park, Heathrow**

ProLogis has set itself an impressive set of sustainability targets for its future distribution facilities, as exemplified by ProLogis Park near Stockley Park, Heathrow. The 5,500m^2 warehousing facility was supplied by Barrett Steel Buildings, and was designed so that it could be disassembled and reused, if required on another site, even down to the level of the ground beams.

The 99m long two-storey structure is constructed in the form of a two-bay portal frame with adjoining office space. The external 'brise soliel' is supported by pencil-thin tubular steel columns and the canopy also reduces the solar gain on the glazed façade.

The high bay portal frames span 24m in two bays and allow a 10m clear space to the underside of the haunch. All steel members are stamped with the section size and grade to allow them to be identified and reused. A total of 80% of the components can be reused.

Some rules of thumb for the reuse of steel

- Plan ahead to tailor the design for the new use around the available materials
- Take care to have the deconstruction process managed carefully
- Do not reuse steel for new structures designed for fatigue (or seismic) situations without being fully certain of the materials mechanical properties and that the original fabrication details are appropriate (e.g. welded stress raising details)
- Bear in mind the costs of additional testing
- To avoid further specific testing, consider using properties taken from historical references (e.g. possibly using a yield strength of 210 N/mm^2)
- Specify that the tolerances for sections should be checked during fabrication to verify that products have not been damaged during deconstruction
- Bear in mind that the steel process route has changed from open hearth to Basic Oxygen Steelmaking (BOS) and concast. This has an effect on chemical impurity levels and this may require a test for chemical composition.
- Establish a relationship with a BCSA Member company prepared to ensure that any necessary additional testing is undertaken, and ask for a quality plan to deal with issues specific to reuse such as CE Marking, matching welding procedures to older material specification and re-filling of previous holes.

University of Toronto's student centre under construction using reclaimed steel

and it is clear that the sections with the greatest potential for reuse are those in long span, bolted, non-composite construction, free of fire protection and other coatings. These are most commonly found in portal frame buildings. That is not to say that other steel sections cannot be reused but rather that portal frame rafters have the greatest range of potential application. Typical portal frame buildings have a life span of about 25-30 years. This means that a great many of the buildings being demolished now were built in and about the start of the 1980s. Figures from steel construction sector surveys indicate that, during that period, approximately 300,000t of structural steel were used in single storey industrial buildings per annum.

The economics of reuse

So, if there is a lot of structural steel in demolished buildings every year, why is it not being reused? The answer to this is generally one of economics. Scrap steel has a value. Because global scrap capture is approaching the upper limits of efficiency, and demand is high, the value of that scrap is significant. New steel from the rolling mills also has a value, which is higher than that of scrap. If steel is to be reused rather than recycled, this difference in value must not be greater than the added costs of recovering and preparing the steel for reuse.

And recovering steel for reuse does incur added costs. Building demolition is usually carried out quickly and the site cleared to facilitate new construction. Recovery for reuse may prolong the demolition process, adding costs. The added complexity of deconstruction rather than demolition may also impact on health and safety and insurance costs.

In addition, recovered steel intended for reuse must have guaranteed properties, which may involve extensive testing. Additional cleaning, welding and fabrication (such as re-straightening sections to meet modern tolerances, repairing unnecessary holes, removing fittings and splicing to increase lengths) may be required. It is also probable that allowance will have to be made for a lack of exact matches between availability and optimising structural efficiency, with the result that structures which utilise reused steel will be heavier than those which use "new" steel.

Costs for certifying the properties of recovered steel are high if it is done on a small scale. The extent and frequency of testing will depend on the information available on the steel, e.g. the amount of testing will be reduced if drawings are available which specify the steel grade. Where a full set of tensile and Charpy tests are required, and perhaps a full chemical analysis, the costs could be significant. However, if a large number of sections are to be tested, economies of scale come into force and costs will decrease substantially.

If all these additional costs are less than the difference between the value of recovered steel for recycling and steel from the rolling mill, then the process of recovering steel for reuse will probably be viable.

Overcoming technical barriers to reuse

Another issue which has been raised with regard to reused steel concerns the impact of the Construction Products Regulation (CPR) and the requirement for CE marking. The CPR applies to products to be incorporated in 'works', where works includes buildings, roads, bridges and other civil engineering works. While not retrospective for products placed originally on the market before 1991, clients are likely to insist on CE Marking to provide a level of confidence in the properties of the re-used steel.

The solution is likely to be that re-used sections can be CE Marked to BS EN 1090-1 (Execution of steel structures and aluminium structures. Requirements for conformity assessment of structural components) provided that the requirements for tolerances, strength, weldability and fracture toughness can be verified.

BCSA and Tata Steel are consortium members of the Wellmet 2050 project which is researching the issues surrounding the reuse of steel.

The assistance of Dr. Mark Gorgolewski of Ryerson University in Toronto in the preparation of this article is acknowledged.

Case Study 2
BedZED, south London

Beddington Zero Energy Development, in south London, is the UK's largest mixed use sustainable community. It was designed to create a thriving community in which ordinary people could enjoy a high quality of life, while living within their fair share of the Earth's resources.

BedZED was initiated by BioRegional and BDa ZEDfactory, and developed by the Peabody Trust. It was completed, using reclaimed steel from a project in Brighton, and occupied in 2002. The community comprises 50% housing for sale, 25% key worker shared ownership and 25% social housing for rent.

People move to BedZED with typical lifestyles, and over the years change their behaviour significantly. The holistic design works on three levels: The design solves problems such as heating and water usage; the design and services offered help people make sustainable choices such as walking rather than driving; and the community have created their own facilities and groups to improve quality of life and reduce their environmental impact.

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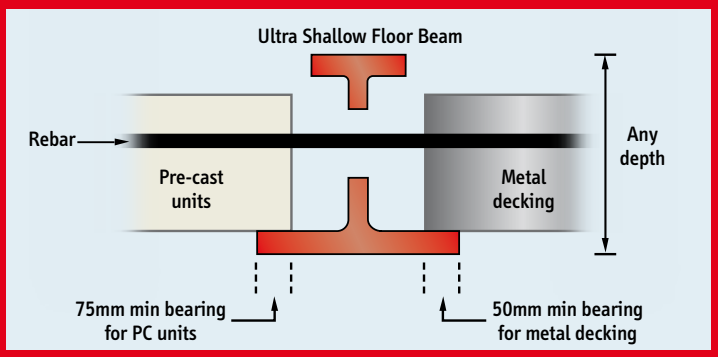

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Trusses create sports mecca

The large transfer truss which forms the roof of the below ground level bowls hall

A steel frame was the only viable solution at the Plymouth Life Centre where long spans abound. Martin Cooper reports from the South West's biggest ever sport and leisure investment.

When it comes to constructing indoor sporting complexes with their necessary long span column free halls, steel has proven to be the natural choice for designers. Its speed and ease of construction are also seen as vital, especially on confined sites with little or no storage space for large pieces of equipment generally associated with concrete works.

Steelwork is fabricated offsite and can be delivered in large pre-assembled pieces ready to be immediately erected. If large long span trusses are needed, then these too can be brought to site in large completed sections, which are then assembled into the complete trusses before being lifted into place.

These criteria have all come to the fore on the Plymouth Life Centre project, currently being constructed on site adjacent to Plymouth Argyle Football Club's stadium. The project consists of one large structure which is compartmentalised into five main sports halls, all of which require large open column free spaces. To slightly complicate matters, one of the halls is below ground level with another large hall directly above it. The site is also extremely tight with limited space for materials storage as it is surrounded by the Football Club's car park, a Park & Ride facility and the city's largest urban park - which can not be encroached upon.

"When it comes to constructing buildings with long spans up to 40m long, which is what we have here, then steel is the obvious option," comments Nils Clemmetsen, Arup Project Engineer. "We also wanted a relatively straightforward and simple design - one which lent itself to a quick construction programme - and again steel was the right choice."

Steelwork for this £46.5M project started in June and SIAC Tetbury Steel will complete the programme before Christmas. Prior to steel starting, main contractor Balfour Beatty had completed the groundworks, which included digging out the area for a below ground level bowls hall and constructing concrete retaining walls (see box story, p24).

Constructing the steel roof over this subterranean sports hall was the first part of the steelwork package. Supported by a retaining wall at one end and steel columns on the inside elevation, a large 42m long x 10m high x 2.5m wide transfer truss was erected in three pieces using two temporary support structures sitting on the lower ground concrete slab. Steel for the truss was erected around the temporary works which were then de-rigged once the truss was in position.

"Once this truss was up, the rest of the steelwork springs off of it," explains Mark Fox, SIAC Tetbury Steel Project Manager.

This truss spans the bowls hall at midpoint and the remainder of the roof was then formed by a series of 1m deep × 22m-long plate girders spanning out from the bottom boom on either side of the truss. Precast planks with a structural topping were then installed on top of these girders to form the floor of a 12-court multi-use sports hall. The truss also forms a ground floor level dividing wall between the sports hall and its adjacent changing room area.

"After we'd completed the steelwork over the bowling alley - forming the desired column free 40m x 40m area - we then erected the project's central spine, leaving the follow-on trades to work on the roof of the bowling alley," adds Mr Fox.

The spine is a two story office and changing room block that runs the length of the Life Centre, effectively dividing it in two zones. Water sports (swimming and diving) are housed in one side, and sports such as climbing, basketball, badminton and of course bowling are on the other side.

"When it comes to constructing buildings with long spans up to 40m long, then steel is the obvious solution."

Structurally the spine performs an essential service, as stability for the whole Life Centre is derived from this block, which is cross braced throughout. Finding uninterrupted areas for the bracing was not too difficult as this internal block has no windows along either of its elevations.

Sequencing has been extremely important on this project as space is at a premium. Once steelwork on one area has been completed it has been handed over immediately to other trades. While SIAC Tetbury were completing the spine structure, the structural screed was being installed above the bowls hall. Once this was completed, SIAC Tetbury was then able to revert back to erecting the frame of the sports hall.

A total of ten 42m-long trusses form the roof of the sports hall and these were brought to site in halves. Once on site they were tied together with tubular bracing and erected with the aid of two mobile cranes. This half of the Life Centre (the Dry Zone) was completed with the erection of a 17m-high climbing block. This will contain a 15m-high wall used as an aerial assault course, abseiling area and for bouldering.

From this month onwards (November) steelwork erection will have progressed onto the pool are, on the opposite side of →

FACT FILE
Plymouth Life Centre
Client: Plymouth City Council
Architect: Archial
Main contractor: Balfour Beatty
Structural engineer: Arup
Steelwork contractor: SIAC Tetbury Steel
Steel tonnage: 1,250t
Project value: £46.5M

The central spine provides the stability for the entire building

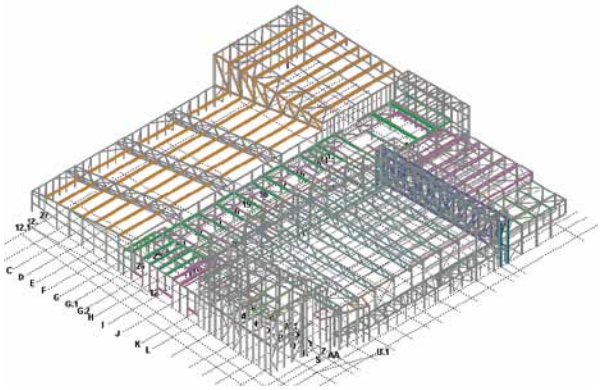
A steelwork solution has resulted in a quick and easy construction programme

the central spine. Prior to steel going up, the three pools will have been formed, which means much of the steelwork will be erected by mobile cranes positioned outside of the structure's footprint.

Forming the roof over the main pool hall, which contains a 50m pool and a leisure pool, are three tubular box trusses. Weighing close to 24t each, the trusses will be brought to site in three 14m long sections, assembled on the ground and complete unit lifted into place by a 250t capacity crane.

"As the perimeter columns are erected we will lose available space for our steelwork and the crane, so the trusses will be brought to site and erected immediately as there won't be any room for storage," says Mr Fox.

The roof of the pool area is a hybrid timber and steel structure, with glulam



Underground bowling

The overall project footprint for the Plymouth Life Centre is constrained by the adjacent football ground's car park and the City's largest urban greenspace, Central Park. One of the structural challenges for the design team was how to accommodate all of the sporting facilities within this footprint.

The Life Centre is effectively divided into wet and dry zones. The wet zone contains a 10 lane 50m swimming pool, a smaller leisure pool with flumes and a diving area containing a 10m-high platform. The dry zone has a climbing facility with a 16m high wall; a multi-purpose sports hall suitable for badminton, five-a-side football, basketball, netball and other sports; a 150 station fitness suite; and a seven lane indoor bowls centre.

"There wasn't enough ground floor space for the bowling alley, so we had to integrate it beneath the sports hall," explains Nils Clemmetsen of Arup. "For access reasons, especially as many of the competitors are likely to be elderly, it was the best solution compared to the only alternative of putting it above the hall."

purlins spanning between the steel trusses. The glulams will have pre-fitted steel end connections and SIAC Tetbury will erect them along with the steelwork.

This side of the structure's shape is dictated by the higher diving pool hall, which has a roof that is a maximum of 10m higher than the pool hall. A higher roof was needed to house the diving platform and to accommodate this change in roof height, another 42m-long truss will be positioned at the roof changeover point. The 10m deep truss will pick up the gables of the lower pool roof and the adjacent higher pool roof.

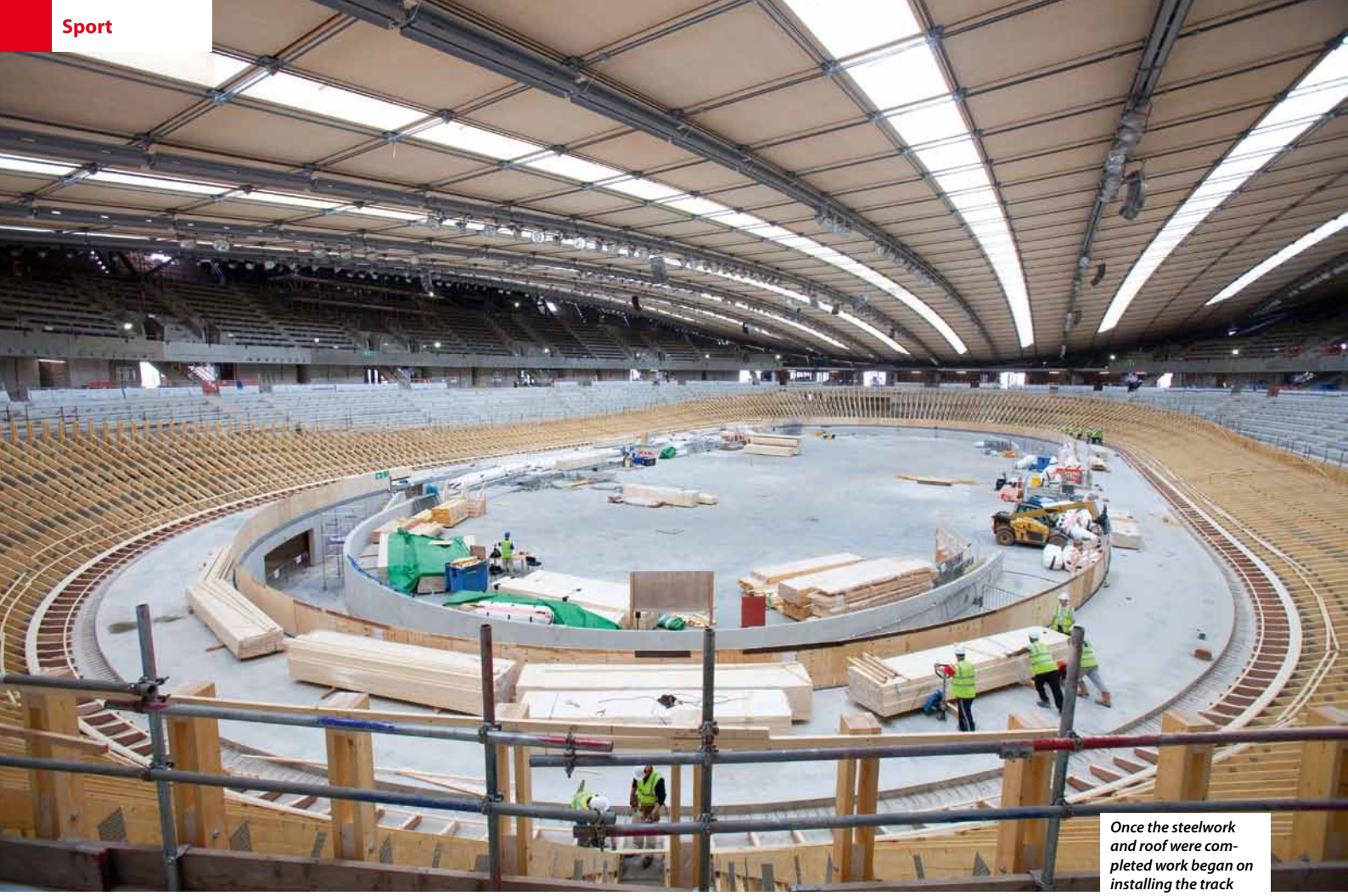
The greater space constraints on this side of the project will mean the pool trusses will arrive on site pre-painted. This is because gaining access to the erected trusses above the pools will be extremely difficult, as previously stated, plant equipment can not stand on the pools concrete slabs, so painting erected steelwork would be extremely difficult.

Another steel element of the pool area is a bank of terracing - precast planks supported by steel rakers - which extends along the inside elevation of the pool hall. Access to this viewing area is from a mezzanine level, positioned directly above.

Summing up, Jim McGee, Balfour Beatty Senior Project Manager says: "This is a 100% public funded landmark project for Plymouth. The city as well as the South West region needs the sporting facilities the Life Centre will provide and once open it could also host national events, putting Plymouth on the sporting map."

Plymouth City Council's Life Centre is scheduled to open during late autumn 2011.

The large truss above the bowls hall was installed in three large sections



Once the steelwork and roof were completed work began on installing the track

Going for cycling gold

The London 2012 Velodrome, with its eye-catching steel formed double curved roof, is nearing completion and will be the first venue at the Olympic Park to host test events next year. Martin Cooper reports

FACT FILE
London 2012 Velodrome
Main client: Olympic Delivery Authority
Architect: Hopkins Architects
Main contractor: ISG
Structural engineer: Expedition Engineering
Steelwork contractor: Watson Steel Structures
Steel tonnage: 1,100t

Great Britain won more medals at the Beijing velodrome than at any other sporting venue at the last Olympic Games. A total of 14 cycling medals were won, including eight Golds, and many believe this rich vein of form can be carried over to the London 2012 Games.

Whether or not Team GB win more or less medals, plenty of records should be broken as the Olympic Delivery Authority (ODA) is aiming to create the world's fastest cycling track by tailoring it geometrically and making sure the venue's temperature is set to optimum conditions.

However fast the cycling track may be, the construction team working on the London 2012 Velodrome have made quick work of the project as it is currently racing towards its completion date of January 2011. This will make it the first venue in the Olympic Park to be completed, with a number of test events to be held throughout the following eighteen months prior to the big event.

Impression of the completed Velodrome

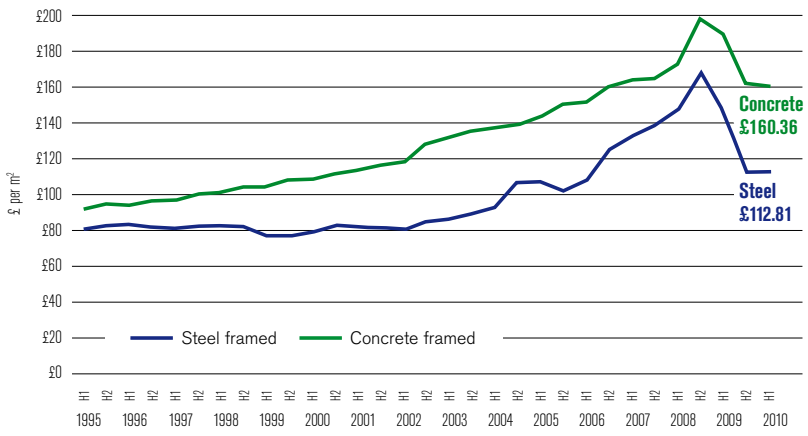
It was only in August 2008 that ground preparation works began on land that was previously used as the West Ham municipal tip. Some 48,000m^3 of material was excavated to create the bowl for the Velodrome (measuring 60m wide by 100m long), enough to fill 19 Olympic size swimming pools.

The tip contained a mixed bag of materials, including rubble dating back to the Blitz. This meant deep piles were needed for the structure's foundations and more than 900 were driven up to 26m into the ground.

Supported on the piles, the main Velodrome structure began to be constructed during the summer of 2009. "It is effectively divided into two parts," explains Richard Arnold, Project Sponsor for the ODA. "It consists of a concrete base and lower tier, with steelwork beginning from a mid level concourse."

The 6,000 seats are split into lower and upper tiers, allowing a 360 degrees concourse positioned in between the two levels to form →

COMPARISON OF STEEL AND CONCRETE FRAME AND FLOOR COSTS BUILDINGS A & B – AVERAGE OF ALL SCHEMES



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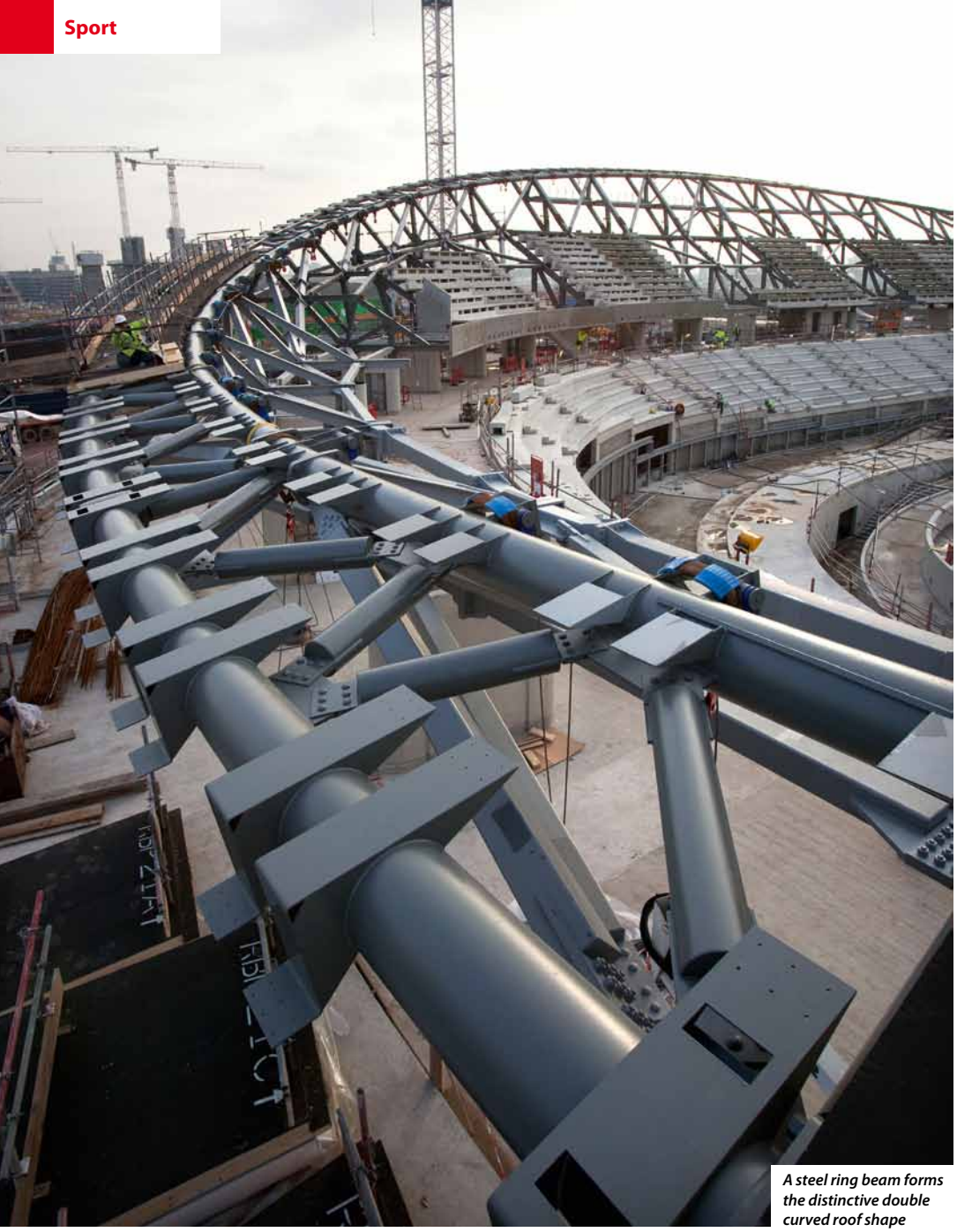


A steel ring beam forms the distinctive double curved roof shape

a continuous ribbon of full height windows. The ODA says this glazed concourse will offer spectators inside the Velodrome views out onto the rest of the Olympic Park, and at the same time allow people outside views into the venue.

The upper tier of the Velodrome is formed by 48 inclined steel trusses (varying in size from 2m high to 16m high) connected to concrete piers. The lower parts of the truss form the steel rakers supporting the upper tier's precast terrace units. Because of the shape of the roof structure, the Velodrome has two upper seating areas positioned on either side of the track and suspended within the two curves of the roof.

A tubular steel ring beam sits on top of the steel trusses and goes around the entire perimeter of the structure, in a rollercoaster fashion, supporting and helping to form the distinctive double-curved roof. The ring beam rises in height by 12m from the shallowest point to the highest part.

In a deal worth more than £3M, approximately 2,500 sections of steel were installed by Watson Steel Structures to complete the steel programme on the Velodrome. Much of the steelwork was pre-assembled into bays, and once erected only the steel bracing needed to be added.

The ring beam is formed from two CHS columns connected by tubular bracing and was assembled into 8m-long sections prior to being erected. Watson Steel began its erection of the ring beam on the eastern end of the venue (one of the two low points of the curved roof) and worked its way around the entire circumference.

Once the steelwork was completed work was then able to begin on installing the venue's roof. In what was one of the largest

The Velodrome is a lightweight sustainable building

cable net roof lifts in the UK, more than 16km of cable was used. The Velodrome is one of the most sustainable venues in the Olympic Park and the lightweight cable net roof only weighs 30kg per square metre, roughly half that of any other covered Velodrome, helping to create a highly efficient building.

The cable net is connected to the ring beam at 3.6m centres and the steel ring beam also acts as a circular compression member. "About 25% of the loads from the roof are absorbed by the ring, while the remainder are transfered down to the foundations via the steelwork and concrete directly below," explains Andrew Weir, Expedition Engineering Project Manager.

"The Velodrome is 50% lighter than Beijing's."

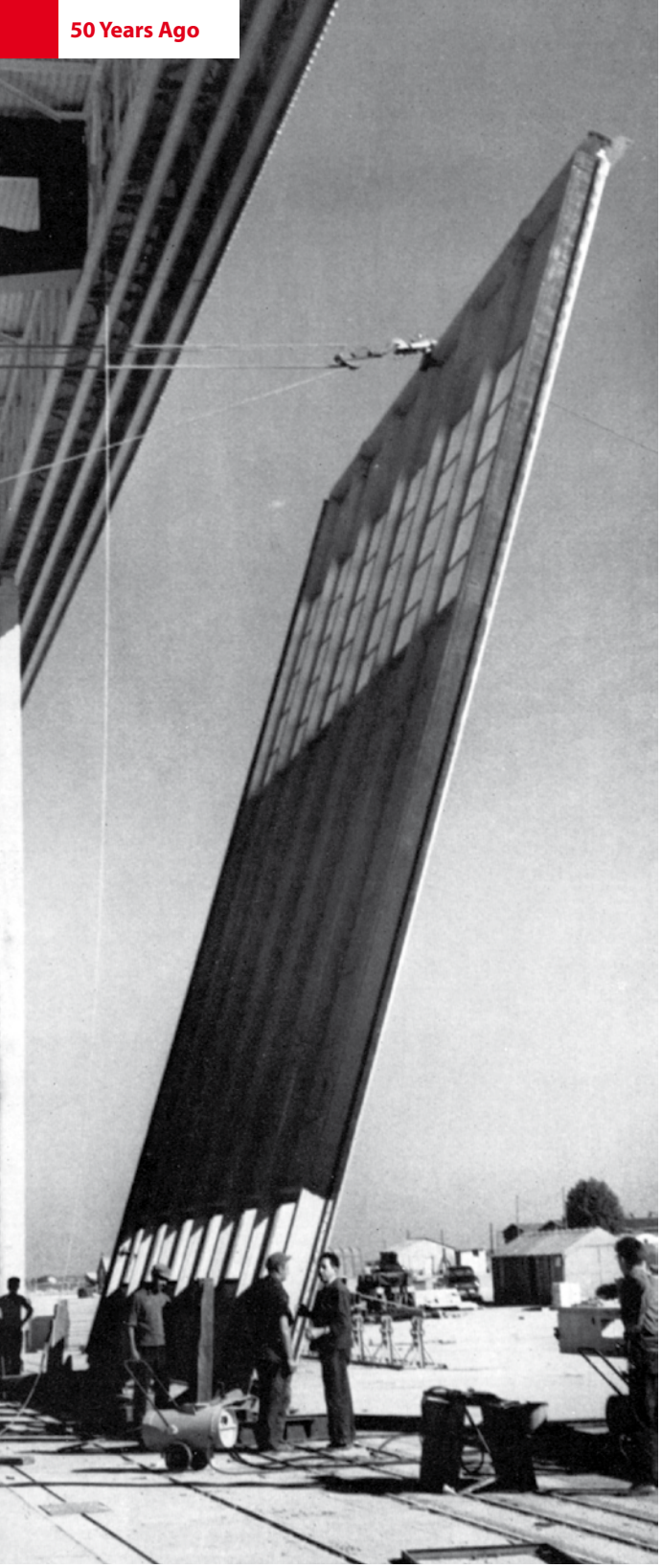
Sustainability has played a major role in the design of the structure, according to Mr Arnold. "The Velodrome is 50% lighter than Beijing's. By using the materials we've chosen for the roof we will have produced a lightweight, efficient and sustainable landmark for the northern end of the Olympic Park."

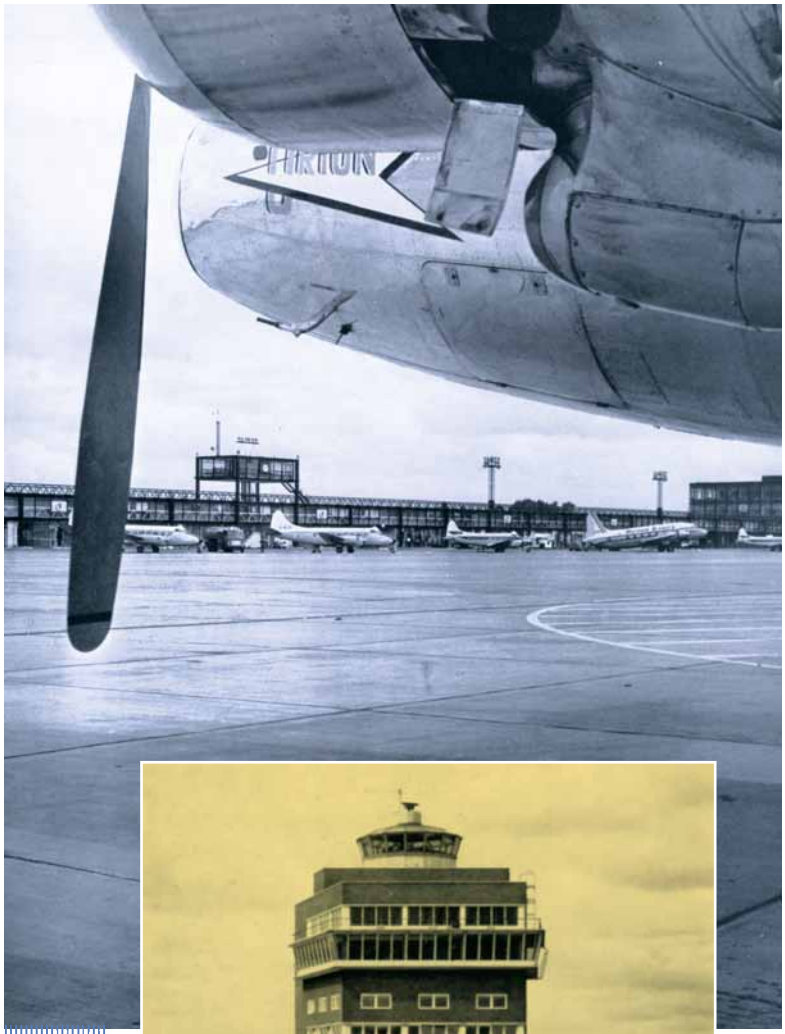
Strategically placed rooflights within the roof will reduce the need for artificial lighting and also allows natural ventilation inside the venue.

On the choice of structural steelwork, Mr Weir adds: "With steel we gained an openness to the upper levels, whereby plant equipment can be discreetly accommodated within the trusses."

Now that the Velodrome is nearing the finishing line, attention has most recently been focused on the inside where a team of 26 specialist carpenters have installed 356 vertical timber support trusses to support the track. This was followed by the installation of 56Km of sustainably sourced Siberian timber to form the track itself, on which in 2012 Team GB hopefully pick up plenty of medals.

Structural steel for airports



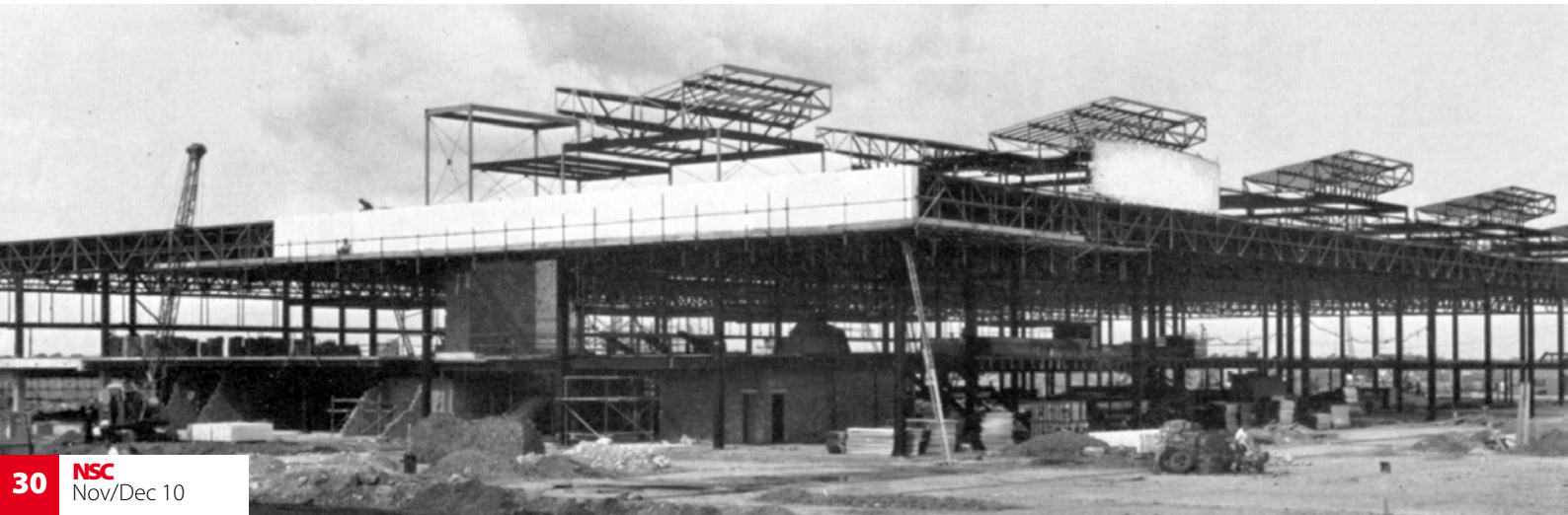


Above: Hangar at Orly Airport, Paris, during erection.

Below: Structural steelwork for the south-west face of the Passenger Building at London Airport in the early stages of cladding. Some 1,500 tons of steel are being used.

Top: Gatwick is another outstanding British airport where many of the buildings are built with steel. Illustration shows part of the terminal buildings.

Above: View from the north-east of London airport showing the air traffic control building, with control tower and east (communications) wing.



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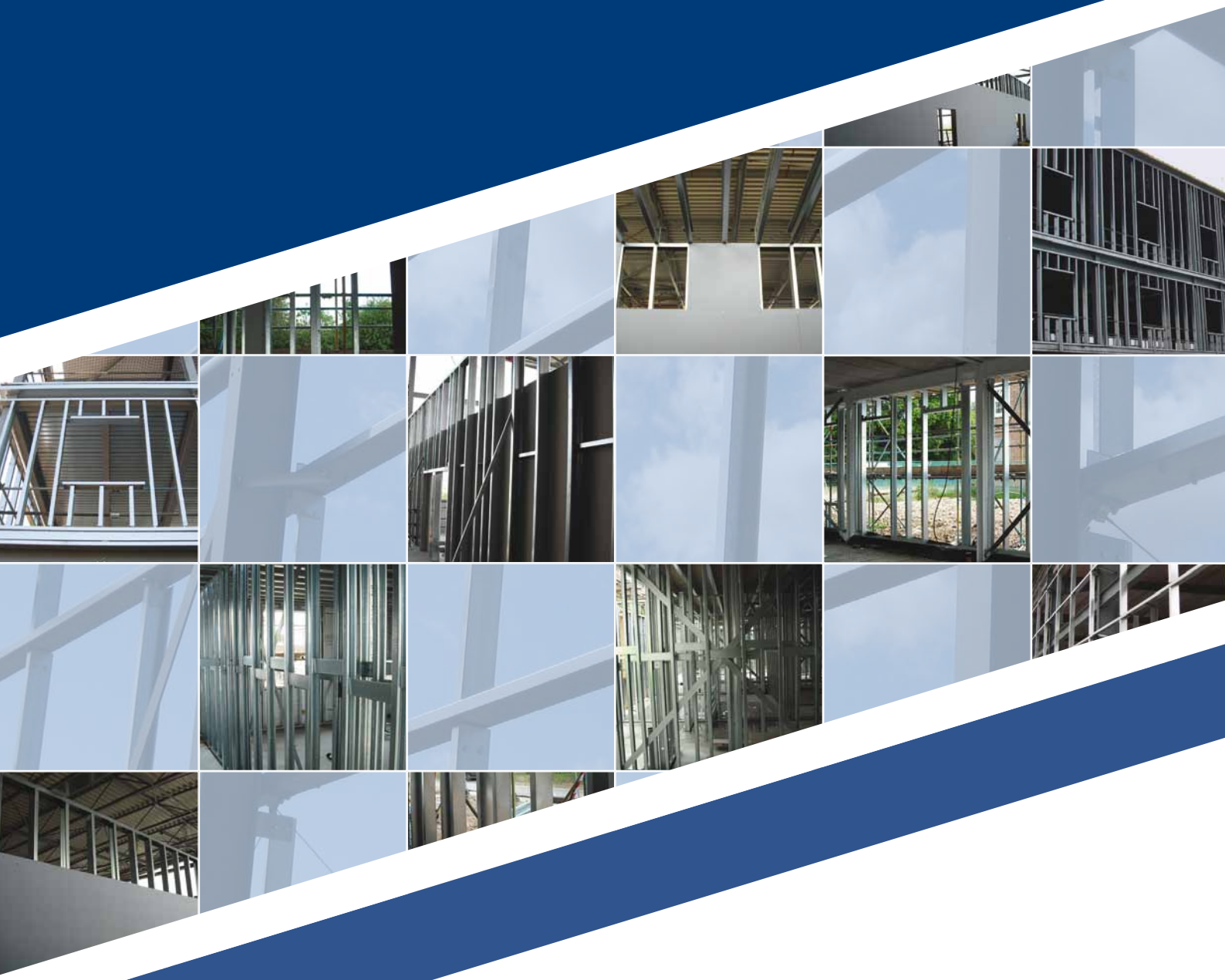

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Mr Doyle's Photograph shows Minster Court, Great Tower Street, London
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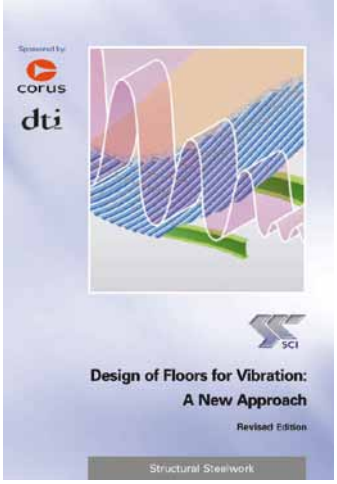
Structural Engineer: Ove Arup & Partners
Steelwork Contractor: Octavius Atkinson & Sons Ltd, with Richard Lees Steel Decking
Owners: Prudential Property Management

First Prize, Amateur Category
awarded to R Taggart
The photograph shows the Times Square Monorail Station, a partly glazed structure formed as a horizontal tube using curved UBs.
Architect: Mr A Jones Building Design Practice
Structural Engineer: Peter Barnsley & Associates
Steelwork Contractor: Midland Steel Frames Ltd in Conjunction with The Angle Ring Co Ltd
Owners: Richardson Developments Ltd

Publications

Design of Floors for Vibration: A New Approach



Without proper understanding of floor vibration, structures can become "bouncy" leading to unstable floors and buildings.

SCI's guidance document Design of Floors for Vibration: A New Approach has been written to enable designers to determine the vibration response of sensitive floors with improved accuracy.

This guidance offers a comparison between BS 6472 and ISO 10137 for general structures and with specific NHS performance standards for hospitals, Health Technical Memorandum 08-01

It includes design guidance for all types of floor construction using steel members. Reference is given to recent research and measurements in a variety of buildings that have demonstrated the good quality vibration performance that can be achieved with composite floors.

Until 3rd Dec this publication is available at £20 + P&P to SCI Members (normally £40) and £60 + P & P to Non SCI Members (normally £80)
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Catalogue number	**P354**
ISBN number	978-185942-176-5
Authors	A L Smith, S J Hicks, P J Devine
Pagination	128 pp
Pages	A4 Paperback
Publication date	June 2007

AD 350
Heating pipes in composite floors – effects on slab beam design

The purpose of this AD Note is to give advice on the design of composite beams and composite slabs when polypropylene heating pipe systems are installed within the concrete slab depth. Recommendations are made for the calculation of the cross section properties for both the composite slab and the composite beam formed with such a slab; recommendations are also given for the assessment of shear connection. It is noted that the concrete slab depth may have to be increased to accommodate these pipe systems, which would have implications for the design of the decking and structure.

Typical floor layout of heating pipes

The heating pipes are usually about 20 mm diameter and are laid in a single plane above the decking on a support system. The layout comprises a series of zig-zag circuits repeated across a floor, with the return pipe from each circuit led back to a manifold adjacent to the feed pipe, as shown in Figure 1.

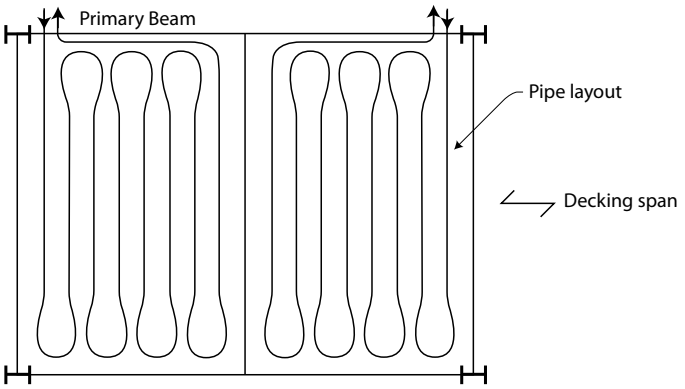

Figure 1. Typical plan view of individual heating pipe circuit for a floor
Positioning of the pipes within the depth of the floor slab

Heating pipes will normally be placed between the mesh reinforcement and the profiled decking. The suggested depth of the zones necessary to install the pipes (including any proprietary supporting system and the reinforcement) is shown in Figure 2. The minimum practical thickness of a composite floor with pipes installed is likely to be at least 150 mm, but is dependent on the depth of the decking.

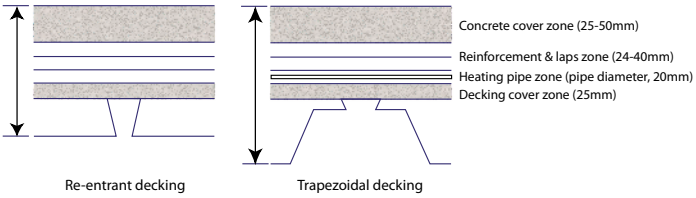

Figure 2. Slab depth zones

Cross sectional properties of composite slabs

Until test evidence is available, it is recommended that a conservative view is taken when calculating the strength of the composite slab with embedded pipes: all concrete displaced by the pipes should be ignored. However, it is thought that the shear connection between the decking and the concrete will not be affected by the presence of the pipes because it relies on mechanical interlock; this interlock will be maintained, provided that the concrete can be compacted properly beneath the pipes. Clearly, pipes should not be grouped together in a way that compaction could be compromised - a minimum spacing between the pipes of the maximum aggregate size plus 5 mm, but not less than 25 mm, is recommended.

Cross sectional properties of composite beams

Bending resistance and stiffness

As with composite slabs, all concrete displaced by the pipes should be ignored when determining resistance. This means that when determining the bending resistance of the composite beam, the pipe area should be deducted from compression stress block in the concrete. Clearly, this is only necessary when the level of the pipe is within the compression zone in the concrete, and it is only relevant when the pipe is transverse to the axis of the beam. The pipe area may be ignored when calculating the composite second moment of area of the beam (for use in stiffness calculations).

Shear connection

It is recommended that, when determining the shear resistance of headed stud connectors, the contribution from a stud should be ignored if the failure surface of the local compression zone around it is intersected by a pipe. The compression zone is illustrated diagrammatically in SCI-P300, Figure 5.5 and from experience of push-out testing carried out by SCI, the spread of the compression zone adjacent to a stud lies at an angle from the top of the stud to its vertical axis of about 60° down towards the decking, as shown in Figure 3. This would suggest that any pipe should be laid a clear distance from the stud of at least 1.75 times the stud height for the resistance of the stud to be unaffected by its presence. For nominally 100 mm long studs, a practical limit of 400 mm diameter circular clearance zone around the stud is recommended. (Strictly, since the potential failure zone occurs on the compression side of the stud, the exclusion zone only needs to be on that side but, for simplicity, a circular zone around the stud is recommended.)

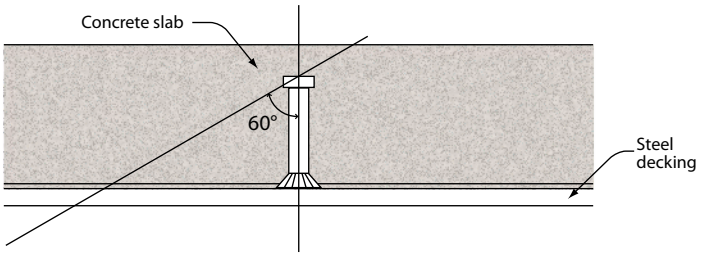

Figure 3. Typical angle of failure surface with a stud

In practice, this recommendation will mean that, for each pipe transverse to the beam, the adjacent the stud or pair of studs would be ignored. It is recognised that this could have a considerable effect on the design of beams for pipe arrangements where numerous pipes cross the beams. If the layouts cannot be arranged in a similar way to that shown in Figure 1, which avoids multiple crossings, it may be necessary to design the beams using non-composite properties. It is also undesirable to place pipes longitudinally to the beam in a way that the circular zone around the studs is intersected. Pipe layouts between beams, with single pipes across the beams only near the columns, may prove to be the most structurally efficient.

Normally, the number of studs on a beam is determined from consideration of the lower of the number required to meet the minimum degree of shear connection rules, (which is based on the span, yield strength and section geometry) and the number based on the force in the concrete to achieve the plastic moment of resistance. The calculation of the force in the concrete (to establish the moment resistance) is dependent on the effective area of concrete, which should not be reduced by the area of the pipe. →

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Longitudinal shear resistance of the slab

In order for the full effective breadth of the concrete slab to be utilised for the composite resistance of the beam, it is necessary for the pipes not to affect the potential shear failure planes in the zones either side of the beam – i.e. the zones to the extremities of the effective breadth. The pipe arrangements in the slab between the beams would have an effect on any potential longitudinal shear plane according to the area of concrete displaced. This effect would obviously diminish for planes nearer to the edge of the effective breadth, where the applied longitudinal shear is lower, and could be zero even for pipes within the effective breadth if there is sufficient concrete and reinforcement to provide the necessary longitudinal shear resistance. Where pipe arrangements employ a single pipe (or a small number of pipes) transverse to the beam, there would be negligible effect on the longitudinal shear resistance of the slab, but pipes running parallel to the axis of the beam will have an effect. In the latter case the area of the pipe should be deducted when calculating the longitudinal shear resistance.

Summary

- Pipe layouts between beams, with single pipes across the beams near the columns, are likely to have the least effect on structural performance.
- All concrete displaced by pipes should be ignored for strength calculations for composite slabs and beams.
- The contribution from any stud to the shear resistance of beams should be ignored when pipes are within a radius of the 1.75 x height of stud (for nominally 100 mm long studs, say 200 mm radius).
- Minimum shear connection rules should be complied with for beams by analysing the required number of studs without the presence of pipes.
- Pipes should be located as shown in Figure 4. The 400 mm width of pipe-free zone is based on the use of 100 mm high stud shear connectors.

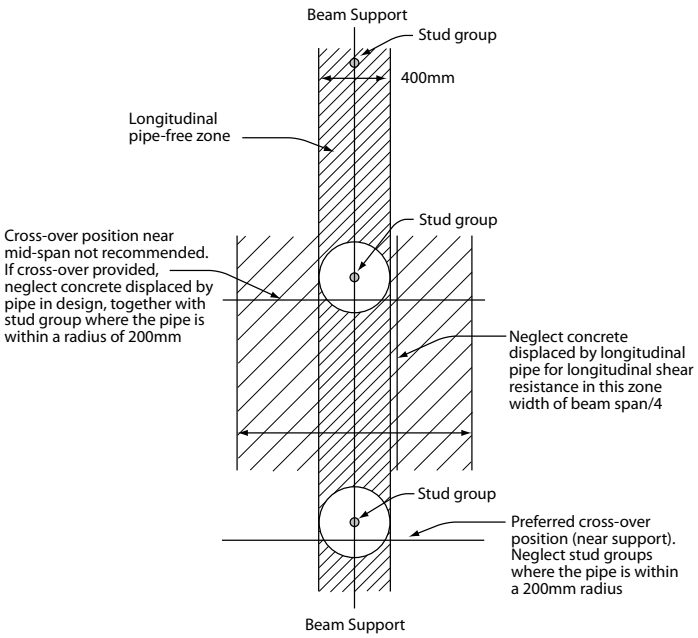

Figure 4. Recommendations for pipe positioning and implications for design for composite beams with 100 mm high stud shear connectors

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AD 351
Tension resistance of angles in SCI P363

The Advisory Desk has received a number of questions regarding the tension resistance tables provided in the "Eurocode Blue Book" (SCI publication P363) for single angles connected through one leg by welding or bolting. This AD clarifies the basis of the values in P363.

Angles connected with bolts

For Eurocode design, four checks are required for angles connected with bolts:

1. A check of the gross cross section, using the yield strength, f_y, as required by clause 6.2.3(2)(a) of BS EN 1993-1-1.
2. A check of the net cross-section through the fastener holes, using the ultimate strength, f_u, as required by clause 6.2.3(2)(b) of BS EN 1993-1-1
3. A block tearing check, as required by clause 3.10.2(3) of BS EN 1993-1-8
4. For angles bolted through one leg only, a check of the effective net section, as required by clause 3.10.3(2) of BS EN 1993-1-8

In general, for angles connected by one leg, the ultimate resistance according to check 4 above will govern. Block tearing could be critical, but is unlikely for orthodox connection arrangements.

The Eurocode provisions for check 4 are limited in the arrangement of bolts that they cover. Clause 3.10.3 of BS EN 1993-1-8 only covers the arrangement of a single line of bolts along the length of the angle, as shown in Figure 1. Different rules are presented for 1, 2 and 3 or more bolts.

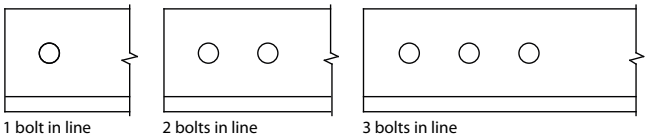

Figure 1. Bolt arrangements covered by the Eurocode (Single line of bolts)

BS EN 1993-1-8 does not cover the situation when there are two or more bolts across the angle leg, as shown in Figure 2. This arrangement is often used to minimise the size of the connection components, such as the gusset plate.

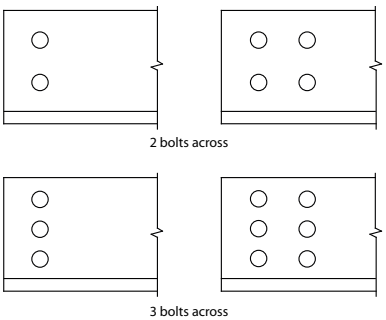

Figure 2. Bolt arrangements not covered by the Eurocode (Two or more bolts across)

Since both bolted arrangements were covered by BS 5950-1:2000 (clause 4.6.3.1), it was decided that P363 would adopt the BS 5950 rules for check 4; this is made clear in the explanatory notes. In addition to providing more comprehensive coverage of practical connections, this choice does have some advantages, because the calculated resistance is independent of the spacing of the bolts. Resistances calculated according to BS EN 1993 1 8, 3.10.3 are dependant on the spacing of the bolts.

The BS 5950 rules are not affected by the number of bolts along the member, or the spacing of the bolts. For this reason only the number of bolts across the angle leg needs to be specified – the tables in P363 are applicable to any number of bolts along the angle. Depending on the leg length of the angle, the tables give the tension resistance values for 1, 2 or 3 bolts across the leg of the angle.

Numerical calculations demonstrate that the resistance calculated in accordance with BS EN 1993-1-8, 3.10.3 can be larger or smaller (depending on the spacing of the bolts) than the resistance calculated according to the BS 5950 rules. At reasonable spacings, the resistances are broadly similar. For strict compliance with design to the Eurocodes, the rules in 3.10.3 should be followed for bolts in a single line along the angle.

The lack of coverage in the Eurocode has been brought to the attention of the responsible committee, and there are indications that a rule will be developed for multiple bolts across the angle leg. In the meantime, it is considered that the tension resistances for single angles quoted in P363 are appropriate for design, even though they are based on BS 5950 rules and not strictly in accordance with the Eurocode.

Angles connected by welds

For Eurocode design, for angles connected with welds the governing check is for the resistance of the effective cross sectional area, using the yield strength, fy, as required by BS EN 1993-1-8, clause 4.13. This clause defines effective cross-sectional area for equal and unequal leg angles.

For consistency with the adoption of BS 5950 rules for angles connected by bolts, the resistances for single angles connected by welding to one leg quoted in P363 are also based on BS 5950 rules (clause 4.6.3.1). The resistances based on the BS 5950 rules are conservative when the angle is an equal angle, or is attached by welding to the longer leg of an unequal angle. If the short leg of an unequal angle is attached by welding (an unusual situation), the Eurocode rule may give a lower resistance, depending on the asymmetry of the angle. For strict compliance with the Eurocode, the rules in BS EN 1993-1-8, clause 4.13 should be followed for unequal angles connected by welding to the short leg.

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BS EN 1993-1-8:2005
Eurocode 3. Design of steel structures. Design of joints
CORRIGENDUM 4
Also incorporates Corrigenda 1, 2 & 3

SPECIAL ANNOUNCEMENTS

BS 0-1:2005
A standard for standards. Development of standards. Specification.

BS 0-2:2005
A standard for standards. Structure and drafting. Requirements and guidance

BS 0. A standard for standards, is the main working document that sets out the principles by which British Standards are developed and published. It was last revised in 2005 and is therefore now due for review. BSI is keen to hear your views on aspects of BS 0 that you feel might need to be reconsidered or changed, and to receive any suggestions as to how best it could be developed. You do not need to be familiar with all it contains, any observations on the processes and policies concerning British Standards will be very welcome.

The current edition of BS 0, currently published in two parts, can be found at: *http://www.bsigroup.com/en/Standards-and-Publications/About-BSI-British-Standards/How-we-produce-British-Standards/*

On the same page you will also find the BSI Guide to standardization and other material relating to the standards development process. You are welcome to comment on these documents also. In all cases your comments can be as broad or as detailed as you wish. This consultation is not intended to replace the formal public comment process, which, if a revision goes ahead, will take place in due course just as for every draft standard. It is intended to help identify themes and major topics which can inform the discussions of the BSI Standards Policy and Strategy Committee (SPSC) when it meets in October to consider the way forward for BS 0.

Observations after the meeting will still be welcome and will be factored into the review process where feasible. They should be addressed to:
Martin Danvers, Email: *BSOperationsDirector@bsi.com*
Comments can be sent by post :-
BSI Head Office, 389 Chiswick High Road, London W4 4AL Tel: 020 8996 9000

BRITISH STANDARDS REVIEWED AND CONFIRMED

BS A 305-1994
(ISO 7961:1994)
Bolts. Test methods

BRITISH STANDARDS UNDER REVIEW

BS EN ISO 7089:2000
Plain washers. Normal series. Product grade A

BS EN ISO 7090:2000
Plain washers, chamfered. Normal series. Product grade A

BS EN ISO 7091:2000
Plain washers. Normal series. Product grade C

BS EN ISO 7092:2000
Plain washers. Small series. Product grade A

BS EN ISO 7093-1:2000
Plain washers. Large Series. Product grade A

BS EN ISO 7093-2:2000
Plain washers. Large series. Product grade C

BS EN ISO 7094:2000
Plain washers. Extra large series. Product grade C

NEW WORK STARTED

ISO 15211
Continuous hot-dip zinc-coated steel sheet of structural quality and high strength steel

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 £2,000,000
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 £400,000
Angle Ring Company Ltd	0121 557 7241												●				Up to £1,400,000
Apex Steel Structures Ltd	01268 660828				●		●			●	●						Up to £800,000
Arromax Structures Ltd	01623 747466	●		●	●	●	●	●	●		●	●					Up to £800,000
ASA Steel Structures Ltd	01782 566366			●	●	●	●			●	●			●	●		Up to £800,000*
ASD Westok Ltd	01924 264121												●				Up to £6,000,000
ASME Engineering Ltd	020 8966 7150				●					●	●			●	●	✓	Up to £1,400,000*
Atlas Ward Structures Ltd	01944 710421		●	●	●	●	●	●	●	●	●	●		●	●	✓	Above £6,000,000
Atlasco Constructional Engineers Ltd	01782 564711			●	●		●							●			Up to £2,000,000
B 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
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
Cairnhill Structures Ltd	01236 449393				●	●	●	●		●	●			●	●	✓	Up to £2,000,000
Caunton Engineering Ltd	01773 531111	●	●	●	●	●	●	●	●	●	●	●		●	●	✓	Up to £6,000,000
Cleveland Bridge UK Ltd	01325 502277	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000
CMF Ltd	020 8844 0940				●		●	●		●	●				●		Up to £6,000,000
Cordell Group Ltd	01642 452406	●			●	●	●	●	●	●	●					✓	Up to £3,000,000
Cougar Steel Stairs Ltd	01274 266800									●					●	✓	Up to £6,000,000*
Coventry Construction Ltd	024 7646 4484			●	●	●	●		●	●	●			●	●		Up to £1,400,000
Crown Structural Engineering Ltd	01623 490555			●	●	●	●		●		●			●		✓	Up to £800,000
D H Structures Ltd	01785 246269				●						●						Up to £40,000
Deconsys Technology Ltd	01274 521700				●					●				●	●		Up to £100,000
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
Fisher Engineering Ltd	028 6638 8521		●	●	●	●	●	●	●	●	●	●				✓	Above £6,000,000
Fox Bros Engineering Ltd	00 353 53 942 1677			●	●	●	●	●			●						Up to £3,000,000
GME Structures Ltd	01939 233023			●	●		●	●		●	●			●	●		Up to £400,000
Gorge Fabrications Ltd	0121 522 5770				●	●	●	●		●				●			Up to £800,000
Graham Wood Structural Ltd	01903 755991		●	●	●	●	●	●	●	●	●	●		●			Up to £6,000,000
Grays Engineering (Contracts) Ltd	01375 372411				●			●		●	●				●		Up to £100,000
Gregg & Patterson (Engineers) Ltd	028 9061 8131			●	●	●	●	●				●				✓	Up to £4,000,000
H Young Structures Ltd	01953 601881			●	●	●	●	●			●						Up to £2,000,000
Had Fab Ltd	01875 611711								●		●				●	✓	Up to £2,000,000
Hambleton Steel Ltd	01748 810598		●	●	●	●	●	●				●		●		✓	Up to £6,000,000
Harry Marsh (Engineers) Ltd	0191 510 9797			●	●	●	●				●	●					Up to £2,000,000
Henry Smith (Constructional Engineers) Ltd	01606 592121			●	●	●	●	●									Up to £4,000,000
Hescott Engineering Company Ltd	01324 556610			●	●	●	●			●				●	●		Up to £4,000,000
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)
Hills of Shoeburyness Ltd	01702 296321									●	●				●		Up to £1,400,000
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*
Leach Structural Steelwork Ltd	01995 640133			●	●	●	●	●			●						Up to £1,400,000
Lowe Engineering (Midland) Ltd	01889 563244									●	●			●	●	✓	Up to £400,000
M Hasson & Sons Ltd	028 2957 1281			●	●	●	●	●	●	●	●				●	✓	Up to £3,000,000
M&S Engineering Ltd	01461 40111				●				●	●	●			●	●		Up to £1,400,000
Mabey Bridge Ltd	01291 623801	●	●	●	●	●	●	●	●	●	●	●		●		✓	Above £6,000,000
Maldon Marine Ltd	01621 859000				●			●	●	●					●		Up to £1,400,000
Mifflin Construction Ltd	01568 613311		●	●	●	●	●				●						Up to £3,000,000
Milltown Engineering Ltd	00 353 59 972 7119			●	●	●	●	●									Up to £6,000,000
Newbridge Engineering Ltd	01429 866722			●	●	●	●								●	✓	Up to £1,400,000
Nusteel Structures Ltd	01303 268112						●	●	●	●						✓	Up to £4,000,000
On Site Services (Gravesend) Ltd	01474 321552				●		●	●		●	●				●		Up to £200,000
Overdale Construction Services Ltd	01656 729229			●	●		●	●			●				●		Up to £1,400,000
Paddy Wall & Sons	00 353 51 420 515			●	●	●	●	●	●	●	●					✓	Up to £6,000,000
Painter Brothers Ltd	01432 374400								●		●				●	✓	Up to £6,000,000
Pencro Structural Engineering Ltd	028 9335 2886			●	●		●	●			●				●	✓	Up to £2,000,000
Peter Marshall (Fire Escapes) Ltd	0113 307 6730									●					●		Up to £1,400,000
PMS Fabrications Ltd	01228 599090			●	●	●	●		●	●	●			●	●		Up to £1,400,000
REIDsteel	01202 483333		●	●	●	●	●	●	●	●	●	●		●			Up to £6,000,000*
Remnant Engineering Ltd	01564 841160				●		●	●	●	●	●			●	●	✓	Up to £400,000*
Rippin Ltd	01383 518610			●	●	●	●	●									Up to £1,400,000
Robinson Steel Structures	01332 574711		●	●	●	●	●		●	●	●	●		●	●	✓	Above £6,000,000
Rowecord Engineering Ltd	01633 250511	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✓	Above £6,000,000
Rowen Structures Ltd	01773 860086		●	●	●	●	●	●	●	●	●	●		●			Above £6,000,000*
RSL (South West) Ltd	01460 67373			●	●		●				●						Up to £1,400,000
S H Structures Ltd	01977 681931						●	●	●	●							Up to £2,000,000
Severfield-Reeve Structures Ltd	01845 577896	●	●	●	●	●	●	●	●	●	●	●	●	●	●	✓	Above £6,000,000
Shipley Fabrications Ltd	01400 231115			●	●	●	●		●	●	●				●		Up to £200,000
SIAC Butlers Steel Ltd	00 353 57 862 3305		●	●	●	●	●	●	●		●	●				✓	Above £6,000,000
SIAC Tetbury Steel Ltd	01666 502792			●	●	●	●				●	●				✓	Up to £3,000,000
Snashall Steel Fabrications Co Ltd	01300 345588			●	●		●								●		Up to £2,000,000
South Durham Structures Ltd	01388 777350			●	●	●				●	●	●			●		Up to £800,000
Temple Mill Fabrications Ltd	01623 741720			●	●	●	●				●	●			●		Up to £200,000
The AA Group Ltd	01695 50123			●	●	●	●			●	●				●		Up to £4,000,000
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)

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

Company name	Tel
Roger Pope Associates	01752 263636
Highways Agency	08457 504030

Associate Members

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

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

Company name	Tel	1	2	3	4	5	6	7	8	9
AceCad Software Ltd	01332 545800		●							
Albion Sections Ltd	0121 553 1877	●								
Andrews Fasteners Ltd	0113 246 9992									●
ArcelorMittal Distribution – Bristol	01454 311442								●	
ArcelorMittal Distribution – Mid Glamorgan	01443 812181								●	
ArcelorMittal Distribution – Birkenhead	0151 647 4221								●	
ArcelorMittal Distribution – Scunthorpe	01724 810810								●	
Arro-Cad Ltd	01283 558206			●						
ASD Interpipe UK Ltd	0845 226 7007								●	
ASD metal services - Biddulph	01782 515152								●	
ASD metal services - Bodmin	01208 77066								●	
ASD metal services - Cardiff	029 2046 0622								●	
ASD metal services - Carlisle	01228 674766								●	
ASD metal services - Daventry	01327 876021								●	
ASD metal services - Durham	0191 492 2322								●	
ASD metal services - Edinburgh	0131 459 3200								●	
ASD metal services - Exeter	01395 233366								●	
ASD metal services - Grimsby	01472 353851								●	
ASD metal services - Hull	01482 633360								●	

Company name	Tel	1	2	3	4	5	6	7	8	9
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 General Steels	01274 682281								●	
Barrett Tubes Division	0121 601 5050								●	
Bentley Systems (UK) Ltd	0141 353 5168		●							
Cellbeam Ltd	01937 840600	●								
Cellshield Ltd	01937 840600							●		
CMC (UK) Ltd	029 2089 5260							●		
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									●
Daver Steels Ltd	0114 261 1999	●								

Steelwork contractors for bridgework

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

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

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

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

Company name	Tel	FG	PG	TW	BA	CM	MB	RF	AS	QM	Contract Value (1)
'N' Class Fabrication & Installation	01733 558989	●	●	●	●			●		✓	Up to £800,000
A G Brown Ltd	01592 630003	●						●	●	✓	Up to £800,000
Allerton Steel Ltd	01609 774471	●	●	●	●	●	●	●	●	✓	Up to £1,400,000
Briton Fabricators Ltd ◆	0115 963 2901	●	●	●	●	●	●	●	●	✓	Up to £3,000,000
Cairnhill Structures Ltd ◆	01236 449393	●	●		●			●	●	✓	Up to £2,000,000
Carver Engineering Services Ltd	01302 751900	●	●	●	●		●	●	●	✓	Up to £2,000,000
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
Donyal Engineering Ltd	01207 270909	●						●	●	✓	Up to £800,000
Four-Tees Engineers Ltd	01489 885899	●	●	●	●		●	●	●	✓	Up to £2,000,000
Francis & Lewis International Ltd	01452 722200							●	●	✓	Up to £2,000,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456	●	●	●	●	●		●	●	✓	Up to £6,000,000
Hollandia BV	00 31 180 540540	●	●	●	●	●	●	●	●	✓	Above £6,000,000
Interserve Project Services Ltd	0121 344 4888							●	●	✓	Above £6,000,000
Interserve Project Services Ltd	020 8311 5500	●	●	●	●		●	●	●	✓	Up to £400,000*
Mabey Bridge Ltd ◆	01291 623801	●	●	●	●	●	●	●	●	✓	Above £6,000,000
Millar Callaghan Engineering Services Ltd	01294 217711	●						●		✓	Up to £800,000
Nusteel Structures Ltd ◆	01303 268112	●	●	●	●	●		●	●	✓	Up to £4,000,000
Painter Brothers Ltd ◆	01432 374400	●		●					●	✓	Up to £6.000,000
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
SIAC Butlers Steel Ltd ◆	00 353 57 862 3305	●	●	●	●	●		●	●	✓	Above £6,000,000
TEMA Engineering Ltd ◆	029 2034 4556	●	●	●	●	●	●	●	●	✓	Up to £1,400,000*
Varley & Gulliver Ltd ◆	0121 773 2441	●						●	●	✓	Up to £4,000,000
Watson Steel Structures Ltd ◆	01204 699999	●	●	●	●	●	●	●	●	✓	Above £6,000,000

◆ Denotes Steelwork Contractor Membership of the BCSA

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	●								
FabTrol Systems UK Ltd	01274 590865		●							
Ficep (UK) Ltd	01924 223530					●				
FLI Structures	01452 722200	●								
Forward Protective Coatings Ltd	01623 748323						●			
GWS Engineering & Industrial Supplies Ltd	00 353 21 4875 878									●
Hadley Rolled Products Ltd	0121 555 1342	●								
Hempel UK Ltd	01633 874024						●			
Hi-Span Ltd	01953 603081	●								
Highland Metals Ltd	01343 548855						●			
Hilti (GB) Ltd	0800 886100									●
International Paint Ltd	0191 469 6111						●			
Jack Tighe Ltd	01302 880360						●			
Kaltenbach Ltd	01234 213201					●				
Kingspan Structural Products	01944 712000	●								
Leighs Paints	01204 521771						●			
Lindapter International	01274 521444									●
Metsec plc	0121 601 6000	●								
MSW Structural Floor Systems	0115 946 2316	●								
National Tube Stockholders Ltd	01845 577440								●	
Northern Steel Decking Ltd	01909 550054	●								
John Parker & Sons Ltd	01227 783200								●	●

Company name	Tel	1	2	3	4	5	6	7	8	9
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						●			
Structural Metal Decks Ltd	01202 718898	●								
Tata Steel	01724 404040				●					
Tata Ireland Service Centre	028 9266 0747								●	
Tata Panels & Profiles	0845 308 8330	●								
Tata Service Centre Dublin	00 353 1 405 0300								●	
Tata Tubes	01536 402121				●					
Tata Wednesfield	01902 484100								●	
Tekla (UK) Ltd	0113 307 1200		●							
Tension Control Bolts Ltd	01948 667700									●
Voortman	00 31 548 536373					●				
Wedge Group Galvanizing Ltd	01909 486384						●			