APRIL 2007 VOL 15 NO 4

NSC

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Mixed use in Folkestone
Column free art gallery
Measuring carbon footprints
Regeneration in Bristol

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steel projects

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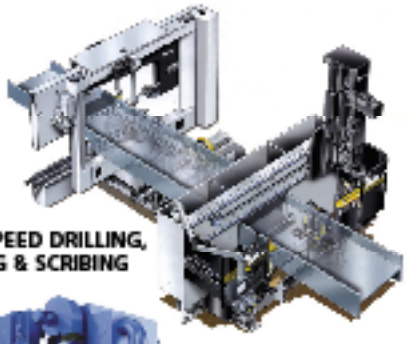

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Consulting Engineer: Powell Tolner Associates
Steelwork Contractor: Robinson Construction

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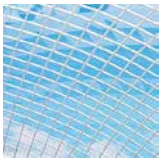

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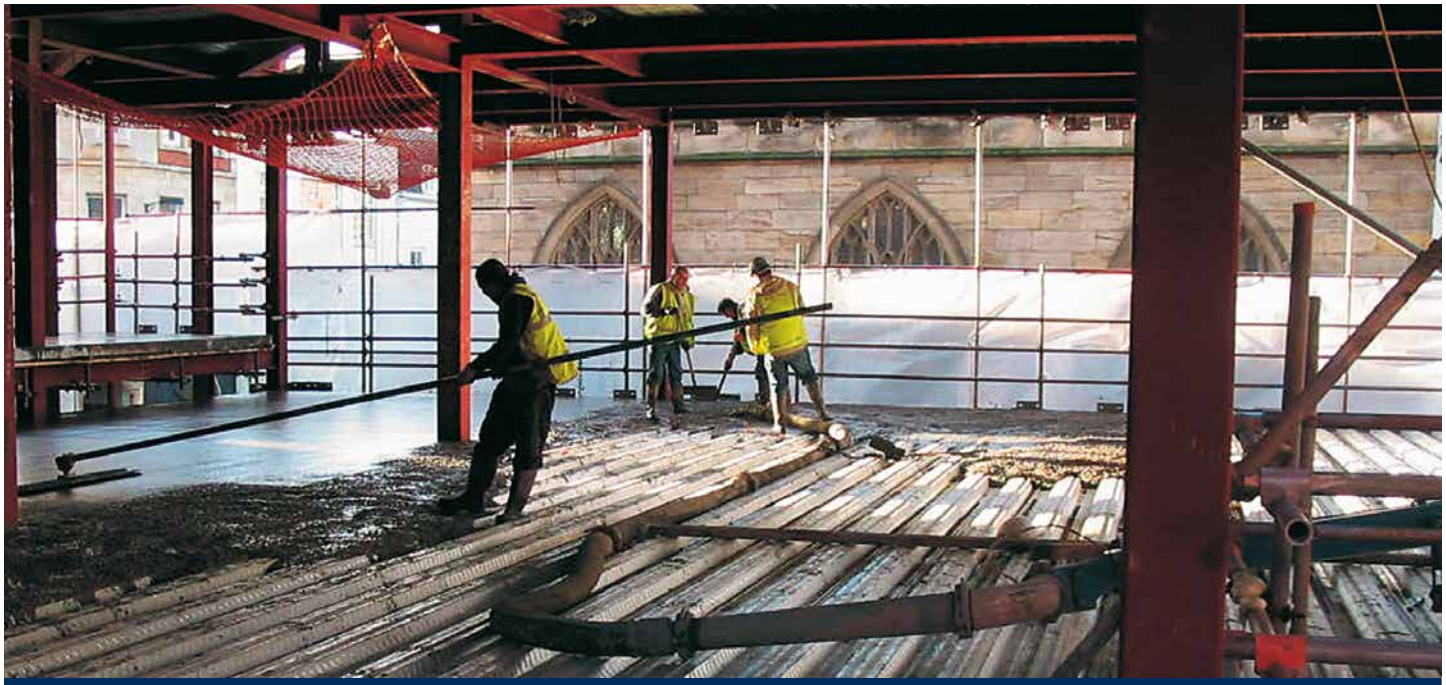

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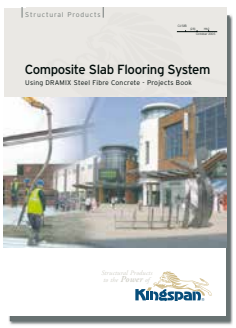

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Worldwide admiration for UK steel

Nick Barrett - Editor

The UK's constructional steelwork sector is the marvel of the world. Well you knew you were good, go on admit it, but to hear it at the BCSA National Dinner from no less a personage than John Spanswick CBE, the Chairman of the Major Contractors Group, who is also Chairman of such a well respected household construction name as the Australian owned Bovis Lend Lease, still must create a certain frisson (see News).

His feeling is obviously also held by clients in the UK market as the latest Market Share Survey shows steel achieving a record level, but it is good to hear that the UK constructional steelwork sector's reputation is so internationally acclaimed.

It was also encouraging to hear a major contracting chief predict such healthy opportunities for the construction industry over the coming years. Education and healthcare were among the bright spots with the Olympics providing a welcome boost – all areas in which steel expects to do well.

It was also good to hear that Bovis Lend Lease recognises that getting labour intensive operations away from site is a way to improve industry performance, which also bodes well for steel. Health and safety has been a major focus of Mr Spanswick's throughout his career, and it was good to hear recognition from him of steel's creditable performance on health and safety.

Not that there is any justification for complacency on that front even in the steel sector. One fact that he mentioned is seldom heard, namely that the construction industry's fatal accident rate, which regularly captures the headlines, is dwarfed by the 3,000 or so occupational health related deaths each year.

Clearly much remains to be done and Mr Spanswick concluded that problems would only be tackled properly and improvements made in health and safety if individuals stand up and be counted. By individuals he means all of you.

Eurocodes transition may be lengthened

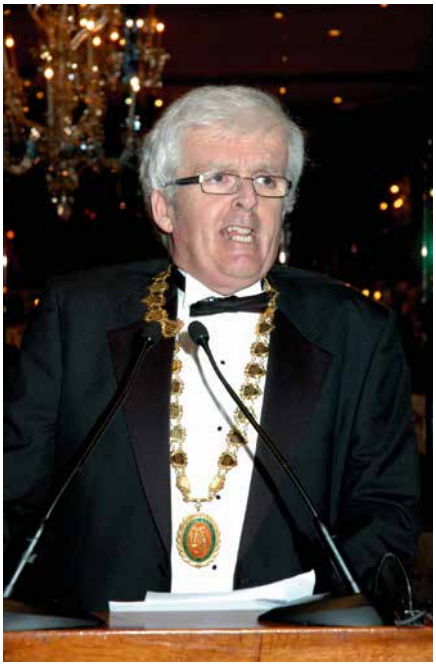
There is another opportunity to stand up and be counted; any readers who think it would be a good idea to increase the transition period allowed for the introduction of Eurocodes to replace British Standards are being invited to register their opinion with the government (see News). Eurocodes are definitely coming, but there is still a strong feeling within the design community in particular that the originally proposed two year transition period is too short.

Corus, BCSA and the SCI have joined others like the Association for Consultancy and Engineering in calling for an increase in the period of overlap. The steel sector is asking for an increase to at least five years.

Government has conceded that two years may not be enough time to retrain some 100,000 design engineers and Building Control officers, but will only extend the period if there is widespread industry support.

Introducing Eurocodes is the biggest change to design rules ever faced by structural engineers so anyone supporting the idea of running the old and new regimes side by side for an extended period should act. Say nothing and you can't complain if you don't like the transition period that is eventually allowed.

Steelwork's future is bright



Donal McCormack - BCSA President.

Steelwork contractors are enjoying healthy forward order books and have captured record shares in key markets, said BCSA President Donal McCormack in his address to the National Dinner.

Mr McCormack also told guests at the Dorchester Hotel on 28 February that there were hopes that the current cycle of steel price rises was approaching its peak. He welcomed the launch of the BCSA's Steel Construction Sustainability Charter last year, which allowed Charter members to demonstrate their sustainability credentials. Steel as a construction material had excellent sustainability credentials, as opposed to concrete which was a major user of cement, which is the world's third ranking producer of CO_2.

Mr McCormack announced the release, later this year, of guidance on the allocation of design responsibilities in structural steelwork projects which would help the construction industry in its bid to provide accurate, timely and comprehensive information to improve sustainability and deliver improved service to clients. A steering group comprising architects, engineers, main contractors, insurers, SCI and steelwork contractors has been developing the guidance that will include checklists setting out all design activities and who is responsible for them.

Mr McCormack called on government to implement reforms to the Construction Act that would rectify payment abuse problems in the industry. He commended the Office of Government Commerce for its part in developing the Fair Payment Charter for the public sector which includes 30 day payment periods and project bank accounts. "These commitments – unthinkable a year or so ago – will make a real difference to the construction industry and its clients," he said.

All necessary preparations were being made for the introduction of Eurocodes, he said, and BCSA was in discussion with ministers to ensure that the planned withdrawal of British Standards from the Building Regulations in 2010 is extended until the new Eurocodes and their supporting documents have been shown to be user friendly, unambiguous and result in safe and economic structures.

Scholarship to boost steel sector recruitment

The BCSA, together with the Ironmongers' Company, is launching a new Steel Construction University Scholarship Scheme to increase the number of school leavers electing to study steel related subjects.

Dr Derek Tordoff, BCSA Director General, said: "In spite of its current strength, the major challenge to the steel construction industry is recruitment."

A particular concern is the fall in the number of engineering students at university, which is 50% less than it was ten years ago. "This presents a significant risk to the future of the industry," commented Dr Tordoff.

The scheme, which will start in time for this year's Autumn term, is specifically aimed at those who are interested in steel related subjects, including civil engineering, but do not have the financial resources to go to university.

"Because the Ironmongers' Company selects and sponsors students at secondary schools it already has the infrastructure in place to choose suitable university students and maintain contact with them during their scholarship careers," explained Dr Tordoff.

The scheme will be operated through the Ironmongers' Foundation, a charitable trust run by the Ironmongers' Company which already supports post-graduate research students and projects for disadvantaged children.

The BCSA and the Ironmongers' Company jointly agreed to sponsor the first steel construction students. However, the BCSA is keen to hear from any interested companies that would like to consider sponsoring or part sponsoring a student, or providing students with Summer work experience.

Norwich schools PFI programme gets under way

Steelwork has been completed on the new £5M Heartsease School project in Norwich, the first of six educational establishments being built by Kier Eastern as part of Norfolk County Council's Norwich Schools PFI programme.

The new facility will house some 420 pupils from the existing Heartsease Middle and First Schools, plus another local school, Woodside First. Kier Eastern preferred sub-contractor A.C Bacon Engineering detailed, fabricated, painted, delivered and erected 140t of structural steelwork and cold rolled roof purlins to form the two-level 1,900m^2 school.

Neville Howling, Director of A.C Bacon Engineering, said the company erected the entire steelwork over a five week programme.

"The steel schedule was a required programme from our client to fit around all the other on-site trades," explained Mr Howling.

A.C Bacon Engineering also installed the 250mm thick pre-stressed concrete planks for the first floor of the school.

"It made sense as we were already on-site with the necessary lifting equipment," said Mr Howling. "Once we'd installed the planks we were then able to complete erection of the roof and purlins."

Heartsease School is scheduled to open in the Autumn, while the entire Norwich PFI programme is due for completion by September 2008, when all the buildings will managed under a 25-year agreement by Kier Managed Services.

CE Marking of fabricated steelwork, purlins, sheeting, and decking was expected to start in late 2007 or early 2008, he said. BCSA is holding a series of seminars to explain all the new requirements related to CE Marking.

Mr McCormack said that the industry's health and safety performance was on an improving trend, with no fatal accidents during the last year and the reportable injury frequency rate down. BCSA members were well on the way to meeting government targets for accident reduction.

Steel sector is the marvel of the world

Guest speaker was Bovis Lend Lease Chairman John Spanswick CBE, also Chairman of the Major Contractors Group, who paid tribute to the BCSA, saying its members "enjoy a tremendous reputation not just in the UK but around the world, setting standards that others should follow". He said he had never seen such prospects as were now open to members, including schools, hospitals, roads, bridges and the Olympics. Taking advantage of the prospects in face of inflation, and skills shortages, for example, was the challenge.

Mr Spanswick was encouraged that the Olympic Delivery Authority was in negotiations with McAlpine for the Olympic stadium, which could be a model for similar scaled projects in the future.

One key to the future would be to get labour intensive operations away from site. Health and safety was improving but there were warning signs that things had stopped improving and there were still a lot of 'near misses' that had to be looked at carefully. There were around 60 deaths a year in construction, but some 3,000 occupational health related deaths and that had to be tackled.

Supply chain management remained an issue. Main contractors and sub contractors might differ on how to tackle jobs, but early involvement of the supply chain in projects would ensure better outcomes.

In conclusion Mr Spanswick said: "We have a great steelwork industry that is regarded as a marvel around the world. You have a lot of opportunities for the future and strong leadership and I do not doubt that you will meet all the challenges of the future."

John Spanswick CBE - Chairman Major Contractors Group.

Visitor centre presents Snowdon summit challenge

A new replacement visitor centre for the top of Mount Snowdon has been been constructed off-site at the Corus Deeside facility.

Main steelwork contractor EvadX is currently trial assembling the entire steel framed structure prior to dismantling it and then transporting it up the 1,085m high mountain by railway.

Andrew Roberts, EvadX Project Manager, said the structure will be taken to the summit in late April and the erection programme will then take up to two months to complete.

"Our erection team will be working at the highest point in England and Wales," said Mr Roberts. "We will be at the mercy of the elements, as winds can get up to 100mph on Snowdon's summit, so it's difficult to judge exactly how long our work will take."

As the Snowdon mountian railway is the only viable way to the summit, EvadX will have to use it to transport everything to the top. This includes the entire 100t of structural steelwork in lengths of no more than 14m, and a small 3t capacity mobile crane.

The new visitor centre will be located next to the Snowdon railway's summit drop-off point and will offer a large cafe with washrooms and information area, medical facilities and an emergency overnight shelter.

The main structure, which measures 27m long x 14m wide, has been a challenge to fabricate and design because of its unusual sloping shape. "All of the perimeter columns are cranked out to form the sloping facade and this proved to be a complex design to detail," explained Mr Roberts.

The one-storey building will also include eight internal feature columns, four 219mm diameter members at the front, and four larger 273mm diameter members at the back.

"These stainless steel CHS members are an architectural element of the structure and will be an eye-catching feature of the completed building," added Mr Roberts.

AROUND THE PRESS

NCE Plus
28 February 2007
Concrete Eurocode fails to tackle thermal cracking
Concrete Eurocode EN1992 fails to properly tackle early-age thermal crack control and could lead to "insufficiently robust design solutions", industry research body CIRIA warned this week. Fears that the new Eurocodes could see designers specifying half the steel required to properly control cracks, prompted CIRIA to this week publish a new design guide to accompany the code.

Building
16 March 2007
The need for speed
"The key to the structural design was that it had to be fabricated off-site and erected in a day," says Bob Lang of Arup. "That was because it had a very confined city centre site next to St Paul's Cathedral and off-site construction would cause the least disruption." Hence there are two large prefabricated steel frames making up both side walls of the St Paul's pavilion.

The Structural Engineer
6 March 2007
Weathering steel for Kent bridges
"Repainting these bridges at a later date for maintenance would have been logistically difficult, bearing in mind one of the structures crosses one of the UK's busiest roads."

Contract Journal
7 March 2007
Efficiency drive
"Off-site fabrication has a reputation for being expensive, but if it allows you to do the job quicker and avoid scaffolding, it becomes very cost effective."

Construction News
22 March 2007
Cement supply investigation
Belgian cartel-busters are looking into claims that the UK cement market is being unfairly controlled by leading suppliers… Independents have long voiced concerns over the stranglehold large producers have on the UK market.

Sustainability charter grows

Two more BCSA members, Conder Structures and International Paint, have been successfully audited under the Steel Construction Sustainability Charter. This brings the total number of companies to have been audited successfully to eleven, with International Paint the first non steelwork contractor to join the Charter.

As part of the audit companies are awarded points, and must score more than six points from a maximum of 12. They then gain Charter Status in three levels, Gold, Silver and Member.

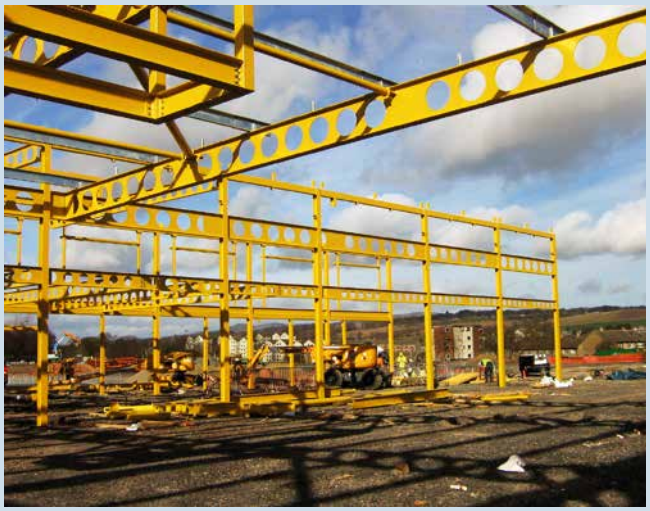
The full current list comprises:

- Barrett Steel Buildings, Gold
- Billington Structures, Gold
- International Paint, Gold
- Cairnhill Structures, Silver
- Conder Structures, Silver
- Elland Steel Structures, Silver
- Fairfield-Mabey, Silver
- Rowecord Engineering, Silver
- ACL Structures, Member
- Fisher Engineering, Member
- Graham Wood Structural, Member

The objective of the Charter is to develop steel as a sustainable form of construction in terms of economic viability, social progress and environmental responsibility.

To fulfill this, members are required to make a formal declaration which includes: operating in an efficient and financially sustainable way; optimising the impact of manufacturing and construction activities; fostering health and safety of employees; and building on their knowledge of sustainability by helping steel and construction companies in the supply chain to implement sustainable policies.

Bone bags five items on Morrisons shopping trip



The Bone Group is currently erecting more than 2,500t of structural steelwork on five different contracts for Morrisons Supermarkets.

Four of the projects in Bristol, Llanelli, Dundee and Wednesbury involve the construction of new Morrisons supermarkets, while the fifth job requires Bone to erect steel for a retail development attached to an existing store in Morecambe.

David Higgins, Bone Group Group Chief Executive, said: "We have years of experience in the retail sector and have a long standing relationship with Morrisons. Not only are these contracts a tremendous boost for the company, but they highlight Morrisons's confidence in our ability to deliver."

Portal frames new business park

Atlas Ward Structures has recently completed the design, fabrication and erection of three distribution warehouses at the Firstpoint Business Park near Doncaster, South Yorkshire.

The park is located on the 120-acre former Manvers Colliery site close to the M18 motorway, and is set to bring several hundred new jobs to the area once it is completed later this year.

Working on behalf of main contractor J.F Finnegan, Atlas Ward has erected a total of 3,200t of structural steelwork for the buildings.

Known as A2, the first warehouse to be completed is a four x 34m span portal framed structure with 33 x 8m bays. Also consisting of an attached three storey office building, the warehouse was erected in five weeks.

Ian Hunton, Project Manager for Atlas Ward, said the other two structures, B1 and B2, have been built in quick succession and were completed at the end of March.

Both these warehouses have three 35m span portal frames, with B1 consisting of 29 x 8.1m bays and B2 slightly smaller with 24 x 8.1m bays.

Industry calls for longer Eurocodes transition period

Government has conceded that the proposed overlap period between introducing Eurocodes and withdrawing British Standards can be extended if there is wide enough support. The steel sector has consequently called for an extension from the original two years to at least five years.

At present, the Eurocodes will be available for practical use early in 2008 and the current timetable envisages all British Standards for structural design being withdrawn from the Building Regulations in March 2010.

The BCSA, Corus and SCI are all backing a longer period in order to ensure a safer transition. Dr Derek Tordoff, BCSA Director General, said: "There would be a real risk of mistakes and potentially accidents across construction if the transition was rushed through at a pace which the industry couldn't cope with."

"There are 100,000 design engineers and building control officers in the UK, retraining all of these people in two years would be an extremely tall order," added Dr Tordoff.

Much effort has already been put into getting the steel sector ready for the impending Eurocodes by way of handbooks, design guides and training courses.

Corus General Manager Alan Todd said: "We're making every effort to ensure the steel industry is ready for the changeover and everything will be in place by 2010. However, it would be more appropriate and beneficial, for the construction industry as a whole, to have a longer transitional period."

The steel industry has a twin policy for Eurocode implementation. Firstly, that all preparations are in place, such as design guidance and training, and secondly that British Standards are kept as long as possible.

"Putting a timescale on how long the British Standards should be kept that this stage is unrealistic," added Dr Tordoff. "Progress on the adoption of the Eurocodes should be continually assessed and then the appropriate time for withdrawal of the British Standards can be decided."

Readers who wish to endorse the need for a safe and orderly transition period of at least five years should write to: Angela Smith MP, Parliamentary Under Secretary of State, Department of Communities and Local Government, 26 Whitehall, London SW1A 2WH.

Quick construction was crucial for St Paul's kiosk

A new and distinctive steel framed kiosk has recently been erected in front of one of London's most famous landmarks in one overnight programme.

The new visitor information centre in St Paul's Churchyard had to be fabricated off-site and erected in one day because of the confined site and the need to minimise daytime disruption.

Consequently, architects for the project, Make, designed a structure that combines both simplicity and efficiency, while also being robust enough to resist deflection while being transported and lifted into position.

Nick Scott, Project Manager for Watson Steel, said: "Speed was critical to the project and the main structure, which consists of two 22m-long trusses each weighing 8.5t, was brought to site and erected during one Sunday night."

"We came back on the following Tuesday and installed the roof steel and then painted the steelwork the next day, which completed our work," said Mr Scott.

The two trusses slope upwards to sharp points either side of the main entrance. They are made up of a series of hollow sectioned rectangular steel ribs laid in parallel like fish bones. These ribs coincide with the

Zander Olsen

joins in the stainless steel cladding panels so that these can be bolted directly through plywood sheathing to the structural frame.

Watson Steel fabricated the trusses in its workshops in Bolton with precision welding that would not have been possible on site.

Multi-span viaduct wins ICE award

The Leven viaduct in south Cumbria has won the Institution of Civil Engineers (ICE) 2007 North West Merit Award for Engineering Excellence.

The ICE judging panel said: "The rail viaduct epitomises the spirit of innovation required of an award winner.

"We were particularly impressed by the specially designed gantries that allowed work to be carried out on both rail lines at the same time and helped the scheme to be completed in half the time of the original programme," commented ICE President Quentin Leiper.

The project required Fairfield-Mabey to supply 2,400t of steelwork for the replacement of all of the 49 spans' walkways and decks.

This was the first time the decks and walkways had been completely replaced.

The project team also included client Network Rail, principal designer Cass Heywood, main contractor Carillion and Corus Railway Infrastructure Services.

NEWS IN BRIEF

Cleveland Bridge will supply approximately 8,000t of structural steelwork for the construction of two 16-storey towers at Canary Wharf in London's Docklands. The project is known as the East and West Towers for Building DS3, and the contract was awarded by Canary Wharf Contractors.

The Institution of Structural Engineers has awarded its annual Gold Medal to former Watson Steel Chief Executive **Joe Locke MBE** (above). The award recognises outstanding contributions to structural engineering. Among the projects Mr Locke has worked on are the roof of Manchester United's Old Trafford stadium, Kansai Airport, Japan, and London's Millennium Dome.

BCSA will be holding two half day seminars on the **National Structural Steelwork Specification** (NSSS) on the 12 June at the Cedar Court Hotel, Huddersfield and 4 July at the Thistle in Cheltenham. Each half day seminar will focus on the main changes to the NSSS and in particular the requirements for welding. Cost per delegate is £60 + VAT (£80 + VAT for non members) and a copy of the 5th edition of the NSSS is included in the price. For more information contact: email david.moore@steelconstruction.org

Severfield-Reeve has recently completed steelwork for British Land's latest London multi-storey tower. Ludgate West will offer 11,800m^2 of office and retail space and required 1,200t of steel.

Modular cores save time in Liverpool

Shepherd Construction is cutting 21 weeks off its construction programme by installing Corus Bi-Steel's Corefast system at its St Paul's Square scheme in Liverpool.

The rapid erect modular Bi-Steel building core system was specified for the lift and stair cores in the 17,000m^2, eight-storey office building which forms part of phase two in the city centre development.

The early designs for the building specified a steel frame with in situ concrete walls to three stair cores, plus two more pairs of lift cores with no cross bracing so all the elevations could be fully glazed.

However, working to this design would have brought the construction programme in later than the client required as well as over budget.

Shepherd re-submitted its tender specifying Corefast, which reduced the programme from 105 to 85 weeks.

Tim Waters, Shepherd's Project Manager, said: "Our team was impressed by Corefast's benefits, especially its speed of construction. This is a tight city centre project and speed of installation was essential."

The steelwork contractor is Billington Structures and its Operations Director, Mike Fewster, commented: "The erection has gone more smoothly that we'd dared to imagine.

"The benefits for us are that we can easily achieve very tight tolerances on building plumb and all the connections for the rest of the frame are already in place," added Mr Fewster.

Airport tower checks in

The final steel sections for the new £8.2M control tower at Newcastle International Airport have been lifted into place.

Steelwork contractor Rippin Steel, working on behalf of Sir Robert McAlpine, used a 500t capacity mobile crane to erect the uppermost element of the new 46m-high tower.

David Jamieson, Rippin Steel Managing Director, said: "We trial erected the top of the tower before bringing it to site. We then reassembled it at the airport with the aid of a jig and then lifted the entire fully decked and clad 50t section into place."

Rippin started work on site in Summer 2006 and began by installing low level steelwork for the tower. This circular base is two levels high and has a 32m diameter at the ground which tapers upwards to a 22m diameter.

The low level steelwork was erected around the base of the concrete core shaft which rises to a height of 40m.

The final high level steel element was lifted so it could slip over and around the top of the concrete shaft to very fine tolerances and was fixed into pre-formed pocket connections.

"This upper level of the tower is very complex," said Mr Jamieson. "It is a heavily welded section which is tapered on elevation and circular in plan."

Surrounding the middle section of the tower, a net of stainless steel tension wires will be installed to create a curved profile.

Diary

For all SCI courses, contact Sandi Gentle, email: education@steel-sci.com telephone: 01344 636500
For BCSA seminars contact Gillian Mitchell, email gillian.mitchell@steelconstruction.org telephone: 020 7839 8566
For all Corus events visit www.corusevents.com, email events@corusgroup.com telephone: 01724 405060

19 April 2007
Excel for Engineers
1 day seminar
Ascot

24 April 2007
Disproportionate collapse and the building regulations
1 day seminar
Cardiff

1 May 2007
Frame Stability
1 day seminar
Dublin

15 May 2007
Portal Frames
1 day seminar
Milton Keynes

22 May 2007
Floor Vibrations - update
1 day seminar
Dublin

22 May 2007
One day seminar on 3D Modelling for the Steel Construction Industry.
Cost £80 + VAT
(£60 + VAT to BCSA members).
Cedar Court Hotel, Huddersfield

23 May 2007
New European standards for fabrication & erection of steel and alumunium structures
One day seminar with The Welding & Joining Society. £170 + VAT (£140 + VAT to BCSA members). National Motorcycle Museum, Birmingham

6-7 June 2007
The design of steel bridges
Wrightington Hotel & Country Club, Wigan.
£215 inc VAT. www.corusevents.com, email events@corusgroup.com. t 01724 405060

12 June 2007
National Structural Steelwork Specification
Half day seminar, Huddersfield.
Full details on p9.

4 July 2007
National Structural Steelwork Specification
Half day seminar, Cheltenham.
Full details on p9.

Steel increases record market share

The latest annual Construction Market Share survey from independent researchers Construction Markets – the 26th in the series - shows that steel is increasingly the framing material of preference in an age when sustainability is dominating agendas. Nick Barrett reports.

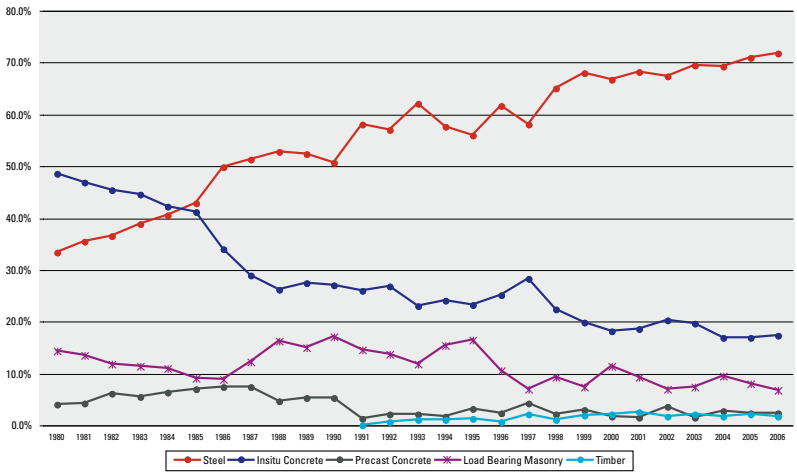
A year ago Corus predicted that the future success of steel would increasingly hinge on getting across messages to the market about the wider sustainability benefits of steel. That prediction has proven to be remarkably accurate, with sustainability having captured the imagination of the public, government and companies alike, part of a widespread recognition that carbon emissions are a key driver of climate change.

The positive steel sustainability messages must have got across, because steel has again increased its market share in key sectors, capturing a record 71.8% of the non-residential multi storey market in 2006, compared to the previous record 70.8% in 2005. "To carry on increasing market share from such a high is testament to the customer focussed hard work put in across the constructional steelwork sector," said Corus General Manager Alan Todd.

"The traditional highly valued benefits of steel like speed, flexibility and cost predictability are being boosted by a growing appreciation of the sustainability benefits".

"The traditional highly valued benefits of steel like speed, flexibility and cost predictability are being boosted by a growing appreciation among designers and their clients of the sustainability benefits. Steel's recognised flexibility, re-usability and ultimately recyclability, as well as independent studies that show steel solutions have lower carbon footprints compared with alternative framing materials, suggest it would be reasonable to expect steel to continue to be the preferred choice."

The survey looked at non-residential multi storey, residential multi storey and single storey buildings. The key non-residential multi storey sector includes offices, retail, leisure, health and education. The survey was based on interviews with 600 architects engaged on projects where the structural frame was completed during 2006. The total market in this sector was found to have been 13,744,000m^2 of floor space, up from 13,258,000m^2 in 2005. The overall offices market showed a 9.5% rise in volume, while other buildings were up by 1.2%. In-situ and precast concrete both saw small improvements in share in the non-residential multi storey category, at the expense largely of masonry and timber.



UK market for structural frames in non-residential multi-storey buildings 1980-2006.

In the residential multi storey sector, for apartment buildings of five storeys and above, the market trebled in size between 2003–2006, and now accounts for 2,534,000m^2 of floor area. Steel's share of this sector has now reached 23.5%. "This is a creditable performance in a sector that until a few years ago you would have struggled to find a single example of a steel frame," says Mr Todd.

The single storey buildings market remained at the same high level as in 2005, with steel's dominance continuing with a share of over 96% of the industrial sector and almost 90% of all single storey buildings.

"These are great results but we are sure there is even more for the constructional steelwork sector to deliver," said Mr Todd. "Our joint industry wide technical and market development efforts will be continued to ensure that designers and end users of steel framed buildings are kept abreast of the latest evidence that choosing steel is the sustainable choice."

Giant steps taken towards reduced carbon footprints

When major developers used the recent Sheds event to lay down their sustainability markers in the strongest recognition from clients yet that construction must be at the forefront of the battle to reduce carbon emissions, the steelwork sector was uppermost in their minds. Nick Barrett reports.

Above: Barrett Steel Buildings designed a building which is 80% recyclable.

The decisive sustainability role that will be played by the steelwork sector was clear from the plans announced by developers ProLogis and Gazeley at Sheds, which included what is said to be the world's greenest property from ProLogis – a 530,000ft^2 distribution centre in Northamptonshire - and the launch of Gazeley's Blue Planet programme - which will be kick started at a 250,000 –450,000ft^2 speculatively built shed at Magna Park, Leicestershire.

A number of steelwork contractors were present at the event, mostly having played significant roles in advancing some of the sustainability plans of their clients. Among them was Barrett Steel Buildings which has announced that it is the first steelwork contractor in the UK, and possibly the world, to measure its carbon footprint. Barrett has measured its carbon footprint in a joint effort with the Steel Construction Institute (SCI) and a carbon solutions company called dCarbon8. "We are delighted to have been able to measure our carbon footprint, but the point of course is to reduce it, and that is our aim," said Managing Director Richard Barrett. The pathbreaking work by Barrett is hoped to provide a blueprint for others to follow as well as acting as a benchmark for Barrett's future sustainability performance.

"We are delighted to have been able to measure our carbon footprint, but the point of course is to reduce it, and that is our aim"

Using steel maximises re-use

The steel sector's commitment to finding out more about environmental impacts and devising ways to minimize them further is of much longer standing than the current wave of interest in sustainability. In 2005 Barrett Steel Buildings set out to prove to what extent a steel framed building can be reused. Barrett designed a building for ProLogis that would allow reuse to be maximised by designing in ease of disassembling it. The building chosen for this was at ProLogis Park, Heathrow, which comprises 50,000ft^2 of warehouse with a 5,000ft^2 office and goods and entrance canopies. The warehouse is a twin 23.6m span, 10m to underside of haunch, 99m long and in predominantly 8m bays.

All of the steel members were hard stamped with the section size and grade for easy identification when the building is eventually deconstructed. Every member was value engineered at the design stage to maximise potential reuse. This meant minimizing welding and notching and maximizing bolting to allow for easy removal of fittings.

Post contract analysis indicated that in all 80% of the frame is reusable and ideas are being developed to increase that figure.

Barrett's next step will be to reduce its carbon footprint before considering offsetting. SCI is undertaking the assessment of the carbon footprint within the construction supply chain under the Planet Positive™ initiative launched at Sheds by Battle McCarthy. The Planet Positive™ initiative is a carbon footprint certification and offsetting scheme. To become Planet Positive™, companies are required to measure their carbon footprint, make commitments to substantially reduce it and offset the remainder by at least 110%. As with all accounting systems there are rules and for Planet Positive™, a protocol has been developed for defining the scope, boundaries and calculation methodology for defining and measuring carbon footprints.

SCI says offsetting allows organisations to indirectly reduce their carbon footprint through the purchase of carbon credits associated with emissions reduction projects such as energy efficiency and renewable power that occur elsewhere, typically in developing countries.

Although opinion is divided on the merits of carbon offsetting, there is support for offsetting as part of robust carbon mitigation strategy, and there is wide agreement that where offsetting is used it should be of the highest standards and should deliver real carbon savings.

ProLogis' and other developers recognise that their business is at the heart of the environmental debate as buildings and transportation account for almost 75% of the world's energy consumption and resulting carbon dioxide (CO_2) emissions. All seem intent on finding sustainable solutions for developments, and recognise that this has to go far beyond simply adopting what was previously Best Practice in use and disposal of materials.

Developers are looking for innovative solutions for reducing energy use at projects and a wide range of renewable and design features will be tested to provide verification of emerging technologies by third-party accreditation. ProLogis is also seeking BREEAM Excellent awards on a number of pioneering warehouse designs.

Simple measures, developers are finding, can achieve surprisingly good results. ProLogis says by reducing building air leakage to less than 2.5m^3/m^2/hr, CO_2 emissions can be reduced by 15%. When roof lights are increased and simple light control systems installed, lighting emissions can be reduced by 23%. Some of these techniques have either no cost or have payback periods of as low as three years.

Above: The steel sector has been leading the sustainability drive for some time as the majority of steel framed structures are re-usable.

Barrett already had a well developed sustainability strategy that has been implemented over the past year or so, and being able to measure what impact its activities were having on the world's carbon emissions was a logical next step. Construction and demolition waste represent 19% of total UK waste and Barrett aimed to bring this figure down by reducing the level of solid waste created in their processes. So there has been a reduction in the use of Volatile Organic Compounds (VOC's) by 4% and shotblast grit has been reduced by 10%, a total of five tonnes in one year. Paint waste to landfill has been reduced by 18% in the same time.

Improved procedures have reduced the amount of scrap produced by over 20% in a year. More has to be done though, recognises Richard Barrett: "Calculating our carbon footprint has been a positive learning curve for our business. We are one of the first in the sector to analyse our footprint and I hope it will help other organisations by being a benchmark across the industry. Working together with dCarbon8 has meant we have had support and advice throughout the evaluation process.

"We worked very hard over the last year to adopt a sustainable way of thinking and establishing our carbon footprint was the next logical step. We are delighted to be a leader in doing so."

The process of measuring the carbon footprint included calculating all of the company's energy use including fuel for journeys to work, transportation of operatives and steelwork and other equipment to site, and quantification of all emissions wherever they took place. Carbon emissions from all areas of the supply chain are looked at.

Steel tops sustainability study

Analysis of the emissions produced by steel and concrete in construction of an Oxford University building confirms the significant sustainability benefits of steel frames. The benefits are so substantial, says Dr Fergal Kelly of PBA, that design appraisals should place as much emphasis on CO_2 as on cost or programme implications

PBA were commissioned as structural and civil engineers for the design of a new departmental building in the Science area of Oxford in 2004. The building consists of four storeys above ground and two basement levels, with a total footprint of around 12,000m^2. See illustration below.

Artist's impression of the proposed departmental building.

The University has a rigorous and knowledgeable approach to sustainability, encouraging the design team to set high standards. So in order to ensure a more sustainable structure for the building, PBA investigated three structural options in terms of CO_2 emissions and embodied energy. The study also included emissions for haulage of materials and arisings.

Option one was a hybrid of the parallel beam system, utilising two levels of orthogonal steel beams, continuous in many locations, supporting a composite slab. Option two was a 350mm thick concrete flat slab structure. The third option was a conventional steel composite structure; however the results for this option were very similar to option one and the results are therefore not reported here.

Key Structural Considerations

Apart from typical structural drivers such as cost, programme, etc., the site location is in a congested area with poor transport access and adjacent buildings in constant use and this meant that number and size of deliveries was a key design consideration. Out-of-hours delivery was one advantage of a steel frame. Propping forces to the basement retaining walls and temporary works requirements during construction were also a factor in the choice of frame.

What is the benefit?

Under the previous set of Part L regulations, construction was typically responsible for around 10% of the energy used during a building's lifetime. With the new Part L regulations, this value is expected to rise to around 25%. Therefore, the contribution from structure is becoming more significant. If the construction industry can reduce the construction CO_2 emissions by up to say 25%, this creates more than a 6% reduction in emissions over the entire lifetime of the building.

Consider for example a renewable energy target of say 10% and its associated financial cost which may be a significant increase in the build cost. Now consider a structure which reduces emissions by 6% but achieves this without an additional financial cost and most likely at a saving. Clearly a structure that achieves an efficient reduction in emissions with little or no capital cost has a large contribution to make in sustainability terms.

Audit of CO_2 emissions

Data on CO_2 emissions has been gathered from various sources and is presented below in Table 1. These values include 'end-of-life' considerations and therefore take account of the fact that steel will be recycled or concrete crushed and re-used for aggregate. The steel data from the International Iron and Steel Institute (IISI) represents global average figures for the products in question. It has been assumed that 85% of the steel in the building will be recycled after demolition of the building (the real percentage for a site might vary but the global figures represent the general case). Data for concrete was averaged from various web-based resources for concrete.

This data has been used to calculate the overall CO_2 emissions and embodied energies of the two options described above. These overall values are shown in Table 2.

It can be seen in this particular case that the CO_2 emissions for the steel-framed option one are 8%

Material	Tonnes CO_2 / tonne of material	Embodied Energy (MJ per tonne of material)
Steel	1.01 T	16837
Concrete	0.142 T	1800
Rebar	0.92 T	12920
Decking	1.34 T	16837
Haulage	1kg per tonne km	4.5 (MJ/tonne. km)

Table 1. CO_2 emissions and embodied energy per tonne of material.

	Option 1 Steel		Option 2 Concrete	
Item	Weight (T)	CO_2 (T)	Weight (T)	CO_2 (T)
Steel	1,340	1,353	50	50.5
Concrete	13,000	1,846	21,760	3,090
Decking	148	198	—	—
Rebar	630	580	1,220	1,122
Excavation	50,600	—	51,520	—
Haulage	3,996 veh	1,270	4,650 veh	1,440
Total		5,247T CO_2		5,703T CO_2

Table 2. CO_2 emissions (tonnes) for Steel Option 1 and Concrete Option 2

lower than the concrete option, resulting in a saving of 456t of CO_2. (To put this into context, the average CO_2 emission per person in the UK is around 10t annually). When the structure above ground was considered in isolation, the steel option had 22% lower emissions. This was a reflection of the heavier than normal steel weights in the basement structure due to propping forces.

It can be seen in this particular case that the CO_2 emissions for the steel option are 8% lower than for the concrete option.

In this case, the steel option was chosen on the grounds that the overall structural cost was comparable, the programme faster, and construction traffic to the site was reduced. It was an additional benefit that the cost and programme savings were achieved in conjunction with superior sustainability credentials.

Design development changes made since the inception of the project, such as a reduction in thickness of the basement slab have also saved around 410t of CO_2 on the original design.

The values for CO_2 emissions for each material were chosen to be as compatible as possible, in terms of reflecting current recycling practice. It is notable that a concurrent Life Cycle Assessment of the same building, which considers other greenhouse gases and particulates, produces a very similar result to this study.

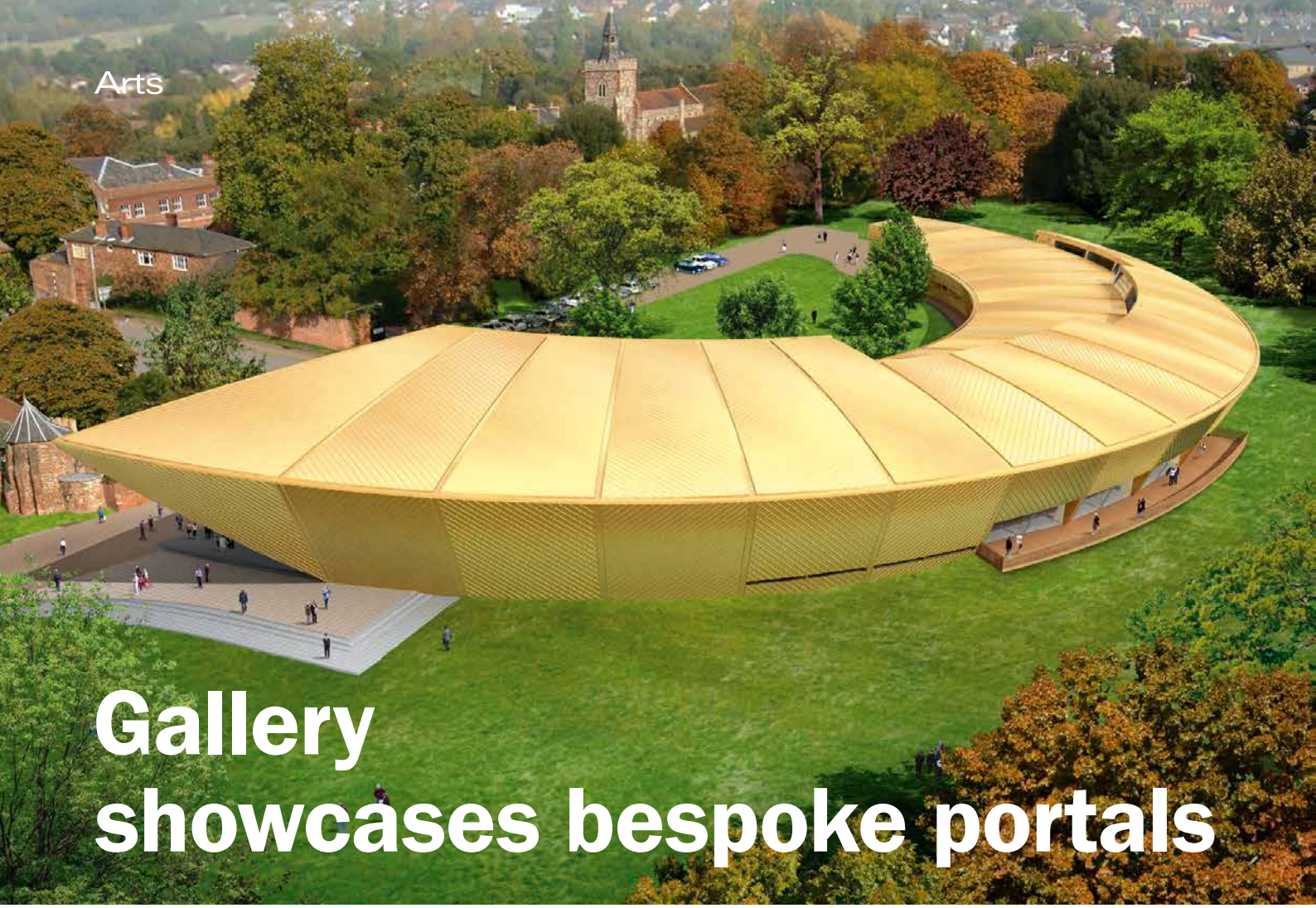
Interestingly, embodied energy figures were similar for both options at around $6.6x10^7$ MJ. This implies that embodied energy figures alone do not sufficiently express the sustainability of a structure, but need to be viewed in conjunction with CO_2 emissions.

Conclusions

As a result of the new Part L regulations, structure has an increasingly important role to play in the overall sustainability of buildings. This brief study of the impact of a structure on CO_2 emissions has demonstrated that there is significant environmental benefit to be gained from carrying out an audit of structural options. This can also be carried out on proposed design changes during the course of the project.

Ideally, an appraisal of structural options or design changes would place as much emphasis on CO_2 emissions as on cost or programme implications. Reducing emissions during construction is in line with the ethos of 'it's easier to save energy than create it' and can be achieved more efficiently and with less capital cost than many renewable energy measures. The study also shows that these benefits can be achieved in conjunction with cost and programme savings, which can only encourage clients and designers to adopt such policies on future projects.

Below: Steel-work contractor William Hare made out-of-hours deliveries to ease on-site congestion.



Gallery showcases bespoke portals

Above: The gallery will be covered in a copper coloured cladding.

A visually stunning ammonite-shaped art gallery featuring no internal columns and a frame which gets progressively higher and wider is under construction in Colchester. Martin Cooper reports.

FACT FILE
firstsite:newsite, Colchester
Main client: *Colchester Borough Council*
Architect: *Rafael Viñoly*
Structural engineer: *Adams Kara Taylor*
Main contractor: *Banner Holdings*
Steelwork contractor: *SH Structures*
Project value: *£16.5M*
Steel tonnage: *400t*

Nestled in the middle of Colchester's historic town centre a new and exciting arts building, known as firstsite:newsite, is rapidly taking shape.

Architects Rafael Viñoly, says the distinctive crescent shape of the structure derives from the available space, while its dramatic copper cladding will give a social as well as architectural impact.

The scheme has been funded by a partnership of Arts Council England East, East of England Development Agency, Essex County Council and Colchester Borough Council. This ambitious partnership aims to create a new visual arts building with regional, national and international significance.

The project is based on the success of the popular contemporary arts organisation firstsite, which is currently housed in an adjacent property.

The new building, firstsite:newsite, will build on this success and offer a wider programme of local artists work and exhibitions as well as providing a permanent space for the University of Essex Collection of Latin American Art. There will also be an evening restaurant and a fully equipped auditorium.

It is hoped that the scheme will also act as the catalyst for a £250M redevelopment of the ancient Roman town's run-down east end. The building is expected to attract more than half a million pounds of Arts Council and other funders' investment into the town.

Work on site began early last Summer and John Gerrard, Associate Director for Adams Kara Taylor, structural engineers for the project, says one of the initial challenges was the fact that it is located on a Scheduled Ancient Monument (SAM).

"This means the ground beneath the site is likely to contain Roman ruins of archaeological interest and cannot be disturbed," explains Mr Gerrard.

Consequently, deep foundations and piles were out of the question; so a flexible raft foundation with a stiff perimeter ring beam sitting on imported fill was investigated and adopted. To avoid high foundation loads the building was limited to a single storey and the 4,500m^2 structure is built off the slab.

"The portal frame reactions are supported by a relatively stiff perimeter ring beam," adds Mr Gerrard.

Dave Poole, Project Manager of steelwork contractor SH Structures, says because there are no piles, designing the connections was a lengthy process.

"The structure has to derive its stability from the connections at the column tops where there was a fairly restricted zone within which to work," says Mr Poole.

The roof cladding sits directly above the roof rafters leaving little or no room for connections. Consequently, many of the connections are actually within depth of the rafters as a suspended →

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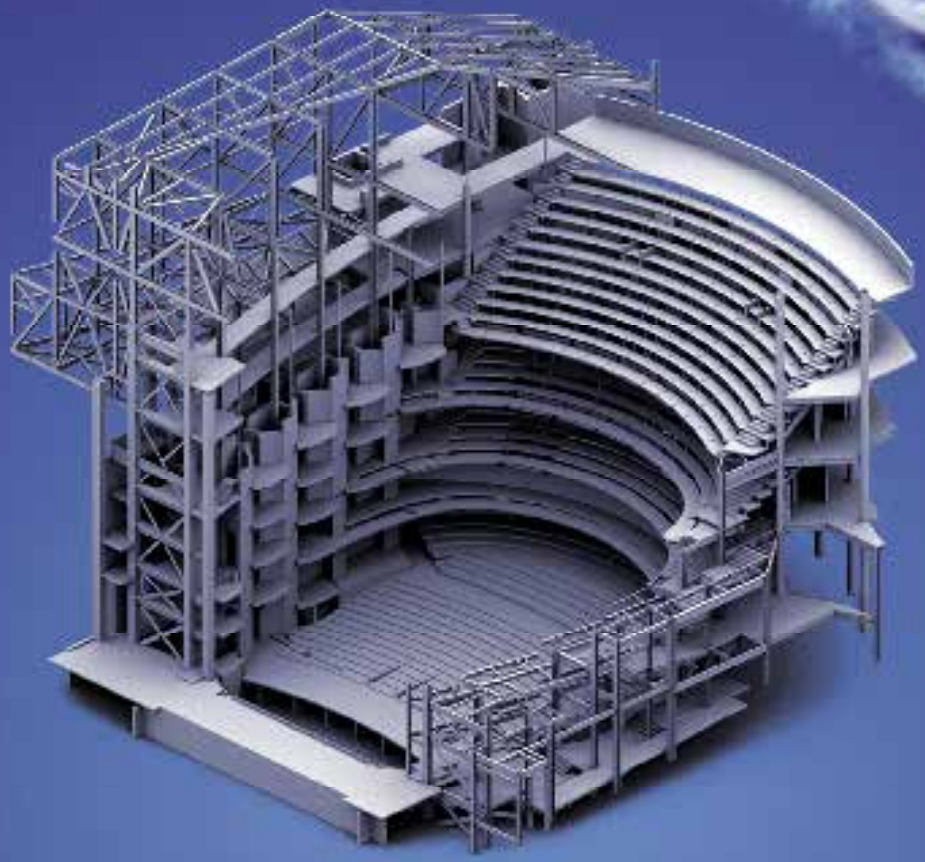

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Left: The perimeter columns lean out at progressively larger degrees.
Below left: The roof rafters all incorporate a step.

ceiling also meant there was limited room beneath the roof.

However, it was also the eye-catching shape of the structure's frame which meant it was interesting to design and erect. "All the members are different and every portal frame span has a different radius and length, they are all bespoke," explains Mr Gerrard.

Mr Poole adds: "The unusual shape of the structure, particularly the way it curves on plan, makes it resemble an ammonite. But the complex part of the steelwork is the fact that the perimeter columns all crank out at progressively larger degrees from east to west, while the building also gets wider and higher in the same direction."

"All the members are different and every portal frame span has a different radius and length, they are all bespoke"

Beginning at the eastern end, the structure's height is 5m but this gradually increases to culminate at a 12m high cantilevered entrance at the western end. Meanwhile the southern elevation, the longer of the two sides at 162m, features perimeter columns which lean out progressively from 11-degrees to 27-degrees east to west - thus twisting the already complex cladding faces.

Meanwhile, the inside elevation, or northern side, is shorter at 90m and its perimeter columns aren't cranked out as much as the southern elevation.

Right: The gallery gets wider and higher from east to west. Below right: The entrance is formed by a large plate girder with members cantilevering off it.

As there are no internal columns, the roof, which has spans of up to 36m at the entrance, was erected with a number of long rafters, which were spliced in the middle. These cranked portal rafters also incorporate a step in their configuration. This step will allow ventilation to the gallery via clerestory.

Dave Chadwick, SH Structures' Site Engineer, explains that there was quite a complicated procedure to erect these long rafters.

"Using two mobile cranes, we had to support the adjacent perimeter columns with guys while a rafter was lifted into position. Once both sections of the stepped rafter were bolted together, we then bolted down the cranked columns, untied the guys and in-filled with secondary beams and columns," he explains.

For the longer southern elevation the 18 main columns are spaced at 9m centres. In-filling beams consist of tubular cross members, while cross bracing was also needed at the top of the elevations.

Possibly the most impressive element of the building, and certainly the one visitors to the finished gallery will notice, is the cantilevered entrance.

"We had to fabricate and erect a large plate girder to form this entrance," says Mr Poole. "This large section carries finger members which ultimately cantilever off it."

The girder is 32m long, 400mm wide and 850mm deep. It is also propped at one end by an 18m long raking CHS column.

In summary, Mr Poole says one of the biggest headaches, as far as design was concerned, was the geometry of the project. "It's never planar and everything had to be calculated to encompass the true curves and twist required for developing the ever changing cladding."

Coastal town goes for retail therapy

A new steel framed shopping centre and residential scheme is set to boost the fortunes of an old seaside town in Kent. Victoria Millins reports.

FACT FILE
Bouverie Place, Folkestone
Main client: *Bride Hall Developments and Warner Estates*
Architect: *GMW Architects*
Consulting engineer: *Powell Tolner Associates*
Main contractor: *HBG*
Steelwork contractor: *Robinson Construction*
Steel tonnage: *2,300t*

Vital regeneration in Folkestone is gaining momentum with construction of a new retail and residential development in the town centre. The decline of the cross-Channel ferry industry, along with poor rail links and the growth of out of town shopping facilities, have all contributed to the demise of a once bustling coastal town.

Bride Hall Developments and Warner Estates have taken on the task of ensuring a brighter future for Folkestone by investing £60M in an ambitious project to build a large modern shopping centre. Bouverie Place will provide over 18,500m^2 of new retail space, a multi storey car park, health and leisure facilities and new residential accommodation.

Constrained between the existing town centre high street, a main road and a busy bus station, the project posed many challenges for steelwork contractor Robinson Construction.

Main contractor HBG is leading construction of the development. Bouverie Place forms the beginning of a number of schemes to regenerate the once popular holiday destination. The Channel Tunnel Rail Link is set to connect Folkestone with St Pancras by 2009, a new state of the art school will improve education opportunities and two new sports centres just outside the town centre will aid the regeneration effort. Work began on Bouverie Place at the beginning of last year.

Over 2,300t of steelwork for the structure has been designed, fabricated and erected by Robinson Construction, including a complex design of two travelators – moving walkways – that cantilever out of the front of the building.

The structure features 17 retail units over the ground floor with a large mezzanine level. Bhs, Next, New Look and HMV are just some of the shops that will occupy the new centre. Meanwhile, Asda will occupy the entire 1st floor with a 7000m^2 store and above that will be two levels of car parking providing approximately 600 spaces.

"The design of the structure had a number of complicated elements for our steelwork," says Robinson Construction's Project Manager Peter Mills. "Loadings had to be carefully considered due to Asda, with the heaviest loading requirements, being on the top shopping floor and then the car park on top of that. The innovative travelators were the biggest challenge in our design." Two modern ramped travelators have been included in the design to allow shoppers to take trollies between shopping levels and up to the car park.

Two modern ramped travelators have been included in the design to take trollies between shopping levels and up to the car park

The travelators cantilever out from the building and over hang by 4.5m. Large steel beam sections will support each travelator and transfer the load back into the structural framework.

Robinson Construction had two 50t cranes on site and two teams of steelwork erectors working together to put up the frame. "Steel was chosen because of the speed with which it can be erected. HBG had a tight construction programme and building the entire centre using concrete would have taken too long," says Mr Mills.

"All of the steel is fabricated in our own factory in Derby. It is transported to site as "just in time deliveries" and erected piece by piece," adds Mr Mills.

Individual beams supporting the top floor of the car park were 23m in length and weighed nearly

Below: Shear studs, welded to the beams during fabrication, form part of the reinforcement system for the car park levels.

9t each. These had to be transported on specially designed rear steer expandable trailers owned by Robinson Construction. The innovative trailers have rear wheel drive which can be controlled by the cab or by remote control. The trailers can be 'folded' back up to the size of a normal lorry once the delivery has been made.

"These vehicles were essential for delivering the longer sections," explains Mr Mills. "Manoeuvring around the tight corners in centre of Folkestone would have been impossible without them.

"Advance planning was crucial for the project to ensure all the steel sections were delivered to site at the right time and that escorts were arranged for the longer sections."

The whole site was very restricted in its size, adds Mr Mills. Steel allowed for most of the fabrication to be carried out off site which ensured space on site was maximised and the length of time it took to erect the steel was kept to a minimum.

A number of unexpected challenges also faced the steelwork contractor. Steel beams had to be connected onto a concrete structure at both ends of the site. "In many cases the connections had been left out of the concrete, so our steelwork had to be temporarily supported and connections had to be resin fixed onto the concrete," explains Mr Mills.

The external car park beams had to be galvanized, therefore the shear studs were shop welded to the beams during fabrication.

The Asda and the mezzanine floors are of a composite design and the shear studs, in these situations, are through deck welded on site.

Mr Mills adds: "A last minute design change has led to a wall in the Asda level being moved slightly. We are currently strengthening a number of the steel sections to cope with the loadings of the new position. If the structure had been concrete these changes might not be so easy to deal with."

Erection of the steelwork began in September last year and on average up to 40 large sections have been erected each day. The main steelwork is nearing completion, while the travelator steelwork will be erected after Easter.

The whole project is expected to be complete and ready for occupancy by the end of the Summer.

Above: Travelators will cantilever out of the building and overhang by 4.5m.

Below: Steel was chosen for its speed, with up to 40 large sections erected each day.

Main picture: The central retail area will have three covered streets.

Covered streetscape to open up city centre

The huge mixed-use Cabot development includes a steel framed retail zone with a difference. Martin Cooper reports on a project which will remain open to the public 24 hours a day and transform a large area of Bristol.

Above: There are no doors to the retail area allowing a free-flow for pedestrians at all times.

Below: The three streets converge at a large covered public square.

The centre of Bristol is currently a hive of construction activity, with numerous cranes towering over the city, as the largest and most important regeneration programme since the post World War Two reconstruction gathers pace.

The £500M Cabot development involves the creation of a new city quarter at the entrance to Bristol, close to where the M32 begins. The scheme, which is due for overall completion in late 2008, will add one million square feet of retail and leisure space to the city's centre.

There are three elements to the development: a central area containing three covered streets of retail outlets, a cinema complex and a four-storey 175,000m^2 House of Fraser anchor department store; a new public square around the historic Quakers Friars, featuring more shops, restaurants and apartments; and 24 affordable housing units with an adjacent 2,600 space multi-storey car park linked into the main central retail zone via a footbridge.

The development is being undertaken by Bristol Alliance, a joint venture partnership between Land Securities and Hammerson.

Robin Dobson, Bristol Alliance Project Manager, says this project is different from the many other city centre re-developments being undertaken in the UK at present. "The central or main retail area. along with the new Quakers Friars square, will be unlike most other shopping developments as they won't be enclosed and will remain open to the general public twenty four hours a day," he explains.

For this reason, Mr Dobson adds, this is a true city regeneration project which will create public areas that will be open to the public even after the shops are closed.

"That's why steel was chosen for this area, not just for its speed of construction, but also its flexibility."

The central retail zone is arranged around three streets which converge in a large public square in front of the House of Fraser store. The streets and square will be covered by a steel and glass grid shell roof which is being fabricated and erected by Portal.

However, as well as keeping the central retail zone open 24 hours a day, and maintaining a covered light and airy atmosphere, the scheme had to be flexible. For this reason the central zone is primarily a steel framed development based around concrete cores.

Mr Dobson comments: "That's why steel was

chosen for this area, not just for its speed of construction, but also its flexibility."

The developers were keen to create a retail environment where units could easily be enlarged or altered in the future. "Steel framed shops are more flexible and tenants will be able to change the unit's configuration. Concrete walls, for instance, are difficult and expensive to knockdown," explains Mr Dobson.

Severfield-Reeve is fabricating, supplying and erecting approximately 13,000t for this part of the project.

Within the central retail zone there are five buildings arranged around the three streets, with a sixth structure - the House of Fraser anchor store - situated at the end of the thoroughfares.

The three retail streets will each have three trading levels, with the top levels linked by six footbridges. Excluding the House of Fraser building, the retail zone will house 15 major stores and more than 100 additional shops.

Interestingly, each of the retail blocks is slightly different from its neighbour, as a different architect from masterplanning architects Chapman Taylor worked on each building to ensure a degree of individuality, but still keeping within the the project's overall vision.

"Steel framed shops are more flexible and tenants will be able to change the unit's configuration."

Grahame Andrews, Director London & South East Region for structural engineer Waterman Structures, says the majority of steel construction has been based around a 7.5m x 7.5m grid pattern, except in the House of Fraser store which has a larger 10.8m grid plan.

"The retail building's individuality will be highlighted in the cladding which will differ, although all of the blocks are different sizes offering varying floor plans," says Mr Andrews.

The largest building is known as Block 6 and this will contain a 13-screen cinema complex on top of two retail levels and one floor of catering outlets. Known as a Cinema de Lux, the complex will cover a 9,300m^2 area and contain more than 3,000 seats throughout its auditoria. The complex will also feature 12 new restaurants, which in the words of the developer, will help to transform Bristol's night time economy.

"Above the retail floors the grid pattern changes to allow for longer spans," explains Dave Lee, Project Manager for Severfield-Reeve. "It was important to have open areas with few columns in the cinema complex," he adds.

As well as some long 20m rafters installed in the cinema, Severfield has also erected some large transfer beams over the project's service yard. The majority of the central retail zone is built on top of two basement levels and these incorporate a service yard which is located under the central square. This yard is also situated beneath two retail buildings and large 20m-long transfer beams have been installed to support the floors.

One of the more challenging aspects of the project for Severfield has been the erection of a number of perimeter cantilevers. Two of the retail blocks cantilever over one of the adjacent streets and, in conjunction with Waterman, Severfield designed and erected the "required packing in certain areas," says Mr Lee.

However, the House of Fraser store juts out over a bus lane with three floors of building above the cantilever. "We had to install a large quantity of temporary props to support this area, and they could only be removed once all the floors were erected and fully decked," says Mr Lee.

Severfield-Reeve is expecting to complete the steel erection at the Cabot development in May. "By that time we'll have erected some 13,000t," says Mr Lee. "But on a project of this size, it's hard to give an exact total as some aspects are still being detailed."

Meanwhile, the roof over the retail zone has been designed by Chapman Taylor, along with UK artist Nayan Kulkarni, and it is said to be one of the largest grid shell structures of its kind in Europe.

"The roof will provide protection from the elements without losing the open air 'city centre experience', one of the key priorities in the overall design," explains Simon Scott, Director at Chapman Taylor.

"There won't be any doors to the streets, allowing a free-flow for pedestrians at all times. As this is a regeneration scheme we are creating covered public open areas which will remain accessible all of the time, and consequently the development isn't turning its back on the surrounding residential area.

The roof's grid form allows for a lightweight construction with no column supports, with spans of up to 60m across the central square. "The roof has a number of curvatures and these address the site's slope and consequently the different heights of the buildings," says Mr Scott.

Commenting on the overall scheme, Councillor Barbara Janke, Leader of Bristol City Council says: "People in Bristol have been waiting a long time for this development. The expansion will make the city one of the top shopping destinations in the UK and bring enormous economic benefits, including some 2,000 new jobs."

FACT FILE
Cabot development, Bristol
Main client: *Bristol Alliance*
Architect: *Chapman Taylor & Wilkinson Eyre*
Structural engineer: *Waterman Structures*
Main contractor: *Sir Robert McAlpine*
Steelwork contractor: *Severfield-Reeve*
Project value: *£500M*
Steel tonnage: *13,000t*

Below: The retail buildings are based on a 7.5m x 7.5m grid over three levels.

BCSA

Steel Construction Books

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National Structural Steelwork Specification

A 5th edition of the National Structural Steelwork Specification for Buildings has been produced. This new version is a half-way house between the 4th edition and the requirements given in the European standard BS EN 1090-2 which will eventually replace BS 5950-2 in about 12 months. Some of the changes include:

- Changes in the specifications for steel sections, structural bolts and welding to reflect changes that have occurred since the publication of the 4th edition
- The introduction of BS EN ISO 3834 for the management of welding activities
- A new section on Liquid Metal Assisted Cracking (LMAC)
- An updated section on hold times based on research carried out by TWI
- A new Annex which gives guidance on the visual inspection of welds

SPECIFYING - The Grey Book

Commentary on the 4th edition of the National Structural Steelwork Specification

This publication provides useful guidance to both specifiers and contractors and can be used as an informative reference.

STEEL BUILDINGS - The Silver Book

Steel Buildings

This book covers everything from steel design; section property tables; industrial and multi-storey buildings; cladding and decking; through to fire; transport and erection; software; contracts and case studies.

STEEL DETAILING - The Magenta Book*

Steel Details

This book provides practical advice on the issues that affect the efficient detailing of steelwork connections. The publication contains a rich array of details from actual structures and allows both engineers and architects to interrogate them.

DESIGNING - The Red Book

The Handbook of Structural Steelwork

This vital handbook gives practical design advice, worked examples, section properties and member capacities. This edition has been completely revised in accordance with BS 5950-1:2000.

GALVANIZING - The Beige Book

Galvanizing Structural Steelwork

An approach to the management of Liquid Metal Assisted Cracking. Practical guidance to clients, specifiers and engineers identifying circumstances where any increased risk of LMAC can be ameliorated.

ASSESSING - The Brown Book

Historical Structural Steelwork Handbook

Developments from the mid-19th Century in iron and steel and the changes in design, loading and stresses; tables of section properties rolled since 1887; guidance on assessment of existing structures.

CONNECTING - The Green Book*

Joints in Steel Construction: Simple Connections

Design guidance and worked examples based on BS 5950 - 1:2000 for connections in buildings designed as braced frames where connections carry mainly shear and axial loads only.

BRIDGES - The Purple Book

Steel Bridges

A practical approach to the design of steel bridges for efficient fabrication and construction.









For help and advice on steel construction and information about companies and suppliers visit www.SteelConstruction.org

All the right credentials

Above: The new facility will utilise a by-product from the adjacent power station.

A new sustainability driven factory is relying on steelwork to provide its required long spans and quick construction time.

A brownfield site in Ferrybridge, West Yorkshire, is the location for Lafarge's new £35M plasterboard manufacturing and distribution facility.

On the site of the former Ferrybridge 'B' Power Station, the new factory is adjacent to the currently operating 'C' power station, and with this location comes a major, if slightly unlikely, sustainability benefit.

The power station has installed a flue gas desulphurisation plant to cut emissions from its flue stacks and a by-product of this equipment is synthetic gypsum.

"Lafarge want the factory up and running before the end of the year."

Nigel Clephan, Lafarge Project Manager, explains: "Gypsum, either natural or synthetic, is the main raw material used in the production of plasterboard. By having our latest facility here at Ferrybridge we will be using the by-product of the power station's latest emissions reduction equipment as our main raw material."

Making use of this by-product has a number of sustainability benefits, such as a reduction in the number of trucks delivering raw materials to the site and the fact that synthetic gypsum increases production efficiency as it is delivered as a wet slurry.

"This means the product doesn't have to go through a crushing stage as the initial stage of our process has already been carried out," explains Mr Clephan.

The plan, once construction is complete and production is up and running later this year, is for the synthetic gypsum for the plasterboard manufacturing to be delivered via a conveyor belt system from the Ferrybridge 'C' Power Station. The rest of the required raw material - natural gypsum - will arrive by rail and road.

The construction of the plasterboard facility is now well under way, with the steel frame nearing completion on the majority of the project.

Caunton Engineering is fabricating, supplying and erecting approximately 800t of steelwork for the main facility, with a further 350t for an adjacent gypsum storage house which will begin construction this month (April).

FACT FILE
Lafarge Plasterboard manufacturing and distribution facility, Ferrybridge, West Yorkshire
Main client: *Lafarge Plasterboard*
Architect: *Farrell & Clark*
Structural engineer: *White Young Green*
Main contractor: *Clugston Construction*
Steelwork contractor: *Caunton Engineering*
Project value: *£35 million*
Steel tonnage: *1,150t*

Above: The warehouse area consists of 8m wide bays.

Paul Cadman, Project Manager at consulting engineer White Young Green, says the project would have been tricky to construct in any other material than steel, particularly with the time constraints.

The need for a warehouse zone with minimal internal columns and long spans led the client - Lafarge - to request a steel-framed factory.

"Steel is also quicker to construct with, and Lafarge want the factory up and running before the end of the year. And, importantly, much of the equipment will start to be installed before the building is even finished," adds Mr Cadman.

Another important consideration in choosing steel was its weight compared to concrete, and consequently the need to install fewer piles.

The steel frame is being erected on new concrete piled foundations around 12m deep. However, if the building was concrete framed the piles would have needed to be deeper and the process would have been more complicated and expensive, explains Mr Cadman.

As the site was once a power station, Clugston had to do some extensive groundworks when they started work in August 2006.

The old foundations were very deep and most had to be dug out along with many other associated obstructions. In line with the project's sustainability credentials, Clugston Project Manager Richard Bowmer, says all of the foundations were broken out, crushed, then re-used for the piling working platform and as bulk fill.

"Steel obviously lends itself to these kinds of alterations."

The main factory building is approximately 25,000m^2 and consists of a large warehouse and distribution area, and an attached plasterboard processing area with plant rooms.

The warehouse area is 208m long (26 x 8m wide bays) and 84m wide (three spans of 28m). Attached to one of the longer elevations of the building is a 16m wide single spanned processing area which is 288m long (36 x 8m grids).

The design of the processing area was modified at quite a late stage. Some columns were discovered to be in the way of the intended equipment and so three of the steel members were omitted.

Denis Morton, Project Manager for Caunton, explains the steelwork was engineered to suit the revised requirement.

Steel's flexibility was highlighted as Caunton replaced one column with portal bracing, while the other members were replaced with longer 16m rafters to increase the grid size.

"The new equipment couldn't have been installed with the original grid sizes as columns were positioned on areas where plant machinery would be standing, and steel obviously lends itself to these kinds of alterations," says Mr Cadman.

Attached to the processing area Caunton is also erecting two internal plant support frames, one a four-storey structure containing four floors.

The larger of the two structures will contain two silos and these units have already been installed with the steelwork having to be erected around them. "They would have been too heavy to lift into the completed structures," explains Mr Morton. "So we are erecting the steel frame and floors around them before putting the roof on."

Once the plant houses are complete, Caunton will begin erecting the steelwork for the final phase of the project.

This last piece of the jigsaw is the gypsum store, which will be a single storey stand-alone structure measuring 80m x 42m with 10 x 8m bays.

This building will accept the synthetic gypsum from the adjacent power station via a conveyor belt system. To support this conveyor system the portal frame structure will have a 4m deep lattice truss across the entire roof width.

Lafarge is scheduled to produce the first sections of plasterboard at the new Ferrybridge facility in October, only five months after the steelwork has been completed.

Above: Lafarge required long column free spans for its warehouse.

Below: The main structure sits on new 12m deep foundations.

SCI leads the debate

Sustainability and off-site steel construction were at the forefront of debate at the recent Futurebuild and Ecobuild events.

Dr Martin Heywood (above) and Dr Michael Sansom (below)

Held at London Earl's Court from 27 February to 1 March, both the conference programme and the exhibition provided a showcase for hundreds of companies offering sustainable design and construction products and services.

Known collectively as Innovations for the Built Environment, five complementary events - Futurebuild; Ecobuild, Regenex, Cityscape and Building for Health – offered an opportunity to focus on the most important themes affecting the built environment, and to reflect on the true complexity of the sector.

On the first day of the exhibition the Ecobuild seminar schedule included the 'Great Materials' debate, with Dr Michael Sansom, Manager Sustainability Group at SCI presenting the case for the sustainability of steel in construction.

90% of the by-products of iron and steel production are recycled. There is only a 1-4% wastage during manufacture, but 100% can be recycled and there is zero waste on site.

Dr Sansom's presentation explained that steel's sustainable credentials were highlighted by the fact that 40% of the material is made from scrap. Steel is also a low waste product as 90% of by-products of iron and steel production are recycled. There is only a 1%-4% wastage during manufacture, but 100% can be recycled and there is zero waste on site.

'Steel is also structurally efficient with a good strength-to-weight ratio," said Dr Sansom. Steel also creates light structures, requiring fewer and lighter foundations which makes it ideal for brownfield developments.

The fact that steel dominates the warehouse sector amply demonstrates how the material creates long span solutions with open and flexible space.

Another important aspect of Dr Sansom's presentation focussed on energy and carbon efficiency. Steel's performance in this area was highlighted by a case study from Oxford University (see NSC page 14-15).

In summary, Dr Sansom stressed steel wins on many fronts. Compared to off-site techniques, traditional building methods in urban locations cause numerous annoyances to local residents. The answer is off-site construction, which reduces the construction period, reduces site activity and associated vehicle movements, creates less dust and noise and reduces waste while increasing recycling.

Meanwhile, off-site construction methodologies were one of the main topics at the Futurebuild conference. Taking place on the final today of the exhibition, SCI again led the debate on steel technology with Dr Bassam Burgan, Deputy Director of SCI, chairing the 'Steel Technology and Off-site Construction' seminar.

Dr Martin Heywood, SCI Manager Construction Technology spoke on the benefits of off-site construction in urban locations specifically, where there is an ever-increasing demand for housing and supporting infrastructure. Together with a shortage of land, new buildings are invariably squeezed into small urban plots and this is where steel and off-site construction comes to the fore.

Some of the main benefits of off-site are quicker speed of construction, cost predictability and waste reduction. To support these benefits, Dr Heywood presented some projects which clearly demonstrated that off-site steel construction methods can deliver faster, better and more sustainable structures. For instance, the construction programme of a secondary school was achieved in 54 weeks instead of the 76 which would have been ordinarily expected.

The reductions of the impact of construction processes on site activity, such as noise, dust and commercial vehicle movements, were also noted, especially where volumetric modular systems were used. However, by far the greatest benefit was the virtual elimination of site generated waste.

Dr Heywood concluded: "RSLs (Registered Social Landlords) and public sector clients are placing great emphasis on sustainability and the impact of construction on local residents. Such focus represents a great opportunity for offsite steel construction."

The exhibitions were held at Earl's Court 2.

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Above: Gala Bingo, Newcastle - 50m span cellular rafters proved more economical than heavier UBs or plate girders.

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To minimise traffic disruption many elements are being lifted into position at night.

Weathering steel links to ease congested junction

More than 4,000t of weathering steel will be used for the construction of four new bridges on the busy A2/A282 junction in north Kent, representing one of the largest ever single uses of this environmentally-friendly material in the UK. Martin Cooper reports.

FACT FILE
A2/A282 Junction, north Kent
Main client: Highways Agency
Structural engineer: Jacobs
Main contractor: Costain
Steelwork contractor: Fairfield-Mabey
Steel tonnage: 4,000t

Nearly 200,000 vehicles use the A2/A282 intersection in Kent every day, creating the knock-on effect of considerable congestion, particularly during peak hours. In order to alleviate severe traffic flow problems at one of the UK's busiest junctions the Highways Agency (HA) has implemented a number of measures.

The road works at the A2/A282 junction began in September last year and are set for completion by Spring 2008. The project includes a major road widening scheme along the A2. However, one of the main drivers of the project is to divert traffic away from the roundabout that sits below Junction 2. This will be achieved by constructing new free flow links, one carrying traffic from the A2 westbound onto the A282 northbound, another from the A282 southbound to the A2 eastbound and a third dedicated lane for A2 westbound to A282 southbound movement.

The new link roads will require four new bridges to be built to carry traffic over existing highways and all of these structures are being built with weathering steel.

"Repainting these bridges at a later date for maintenance would have been logistically difficult, bearing in mind one of the structures crosses one of the UK's busiest roads," explains Gordon Taylor, Project Manager for steelwork contractor Fairfield-Mabey. "Once these structures are erected there is no need for any painting."

In contrast to other steels, which always look their best immediately after being erected, weathering steel is said to improve after a couple of years exposure to the elements. Architects increasingly specify it for use on buildings, fully exposed.

"The colour of weathering steel can change from orange brown to a dark brown or even purple," explains Mr Taylor. "Which looks aesthetically pleasing and surprises many people who think the steel will just look rusty."

> **"The colour of weathering steel can change from orange brown to a dark brown or even purple."**

There is also an environmental and cost advantage connected with using weathering steel. "No painting in the future will obviously save money, but there won't be any paint spillages, which is good for the environment," says Robert Phillips, Costain Project Manager.

The longest bridge to be built is the A2 westbound to A282 northbound flyover, known as S01, which is a 420m-long nine span viaduct. Fairfield-Mabey will erect more than 1,800t of weathering steel for this bridge in two separate lifting programmes.

The company started work on site at the beginning of January, but only started erecting steelwork in February.

"We gave ourselves four weeks to assemble some sections on site, so that when we brought the required 1,000t mobile crane on to site we'd have enough →

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Above: the majority of steelwork is lifted by one 1,000t capacity crane.

sections ready to erect several spans in one visit of the crane," Mr Taylor explains.

Unusually, the middle section of the bridge is being erected first, with Fairfield then working southwards, completing six of the nine spans in one sequence. This section of work will see the bridge erected over the A2, but not over the A282.

Unusually, the middle section of the bridge is being erected first.

"The concrete piers at the northern end of the bridge haven't been built yet," explains Mr Taylor. "That section is going to be quite challenging as Costain is forming piers either side of one of the UK's busiest highways." The last two piers are currently under way, and once complete Fairfield will erect the last sections of the viaduct in May.

The bridge's nine spans carry the structure over eight piers and two abutments. Five of the concrete formed piers have four columns, while the three middle piers only have two.

"It's all down to aesthetics and cost," says Mr Taylor. "The fewer columns in a pier the easier it is on the eye, while money is saved as less concrete needs to be poured," he adds.

Another important factor in the column disparity among the piers is the location of the bridge. The middle three spans traverse open ground and consequently there is enough room for temporary support trestles to be erected during the lifting process.

"The piers allowing the bridge to cross the two major thoroughfares are placed in the middle of the roads and there just isn't room for temporary works," says Mr Taylor.

The extra two columns per pier consequently act as permanent support for the bridge as well as temporary support during the erection programme.

"As the majority of the piers are situated in the middle of existing roads we've had to ensure there's minimal disruption to traffic," says Mr Phillips. "This will also apply to the steel erection process and this is being achieved with a number of temporary roads," he adds.

All nine spans of the bridge vary in length, from the longest at 59m to the shortest at 38m. The build up of the structure is multi-span and it also curves along its entire length by approximately 45-degrees from west to north.

Steelwork for the bridge deck consists of two braced pairs of girders for each span, and these are paired up on site and lifted into position by the 1,000t Liebherr crane. Cross members are situated at 8m intervals. Each pair of girders consists of four steel sections which are bolted together on site and readied for erection.

During assembly, Costain has also taken the opportunity to install its GRP formwork onto the girders so it is in place for concrete pouring to begin.

"This just cuts down on crane usage," explains Mr Phillips. "Otherwise we'd only have to come along again later and lift the formwork into place." Typically this adds another 30t to each lift, with braced girders typically weighing 100t.

Costain in conjunction with Fairfield-Mabey has worked out seven optimum positions for one crane to lift all of the bridge decks into place. During the steel erection process the concrete deck will then be poured, following on, three spans behind the steelwork.

Meanwhile, to the east of the main bridge, two other steel structures are under construction. Each requiring 1,000t of weathering steel, these two parallel five span bridges are both 250m-long and are situated either side of the A2.

One structure will carry traffic from the A2 over the Darenth Valley and then onto the S01 bridge, while the other structure feeds traffic onto the A2 from the A282 southbound.

The steelwork construction for these bridges is slightly different as they are ladder beam decks and they are being built without requiring road

possessions. Spans vary between 33m and 50m on these bridges.

Similar to the larger bridge, Fairfield has another assembly yard adjacent to these bridges and the company will erect them both during one 12-week programme. Assembly and erection consists of bringing beams to site in sections and bolting them together on the ground before being lifted into position.

Once a pair of ladder beams have been positioned onto the pier, 10.3m long cross members are then bolted into place at 3.5m intervals.

The cross beams are generally 900mm deep members, except those at the piers which at 2.35m deep are almost as deep as the 2.6m deep main girders. "These beams are taking the wind loading through the rigidity of the piers, while the other members are just supporting the concrete bridge deck," explains Mr Taylor.

During May, Fairfield will also erect the fourth and final new steel structure. Known as S04, this bridge will require 230t of weathering steel and is the smallest of the structures. It carries southbound A282 traffic over a small slip road before linking up with the A2.

"With no painting work to be done the erection of this small structure will bring to an end one of the largest weathering steel projects we've ever done," sums up Mr Taylor.

Optimum positions have been located for the cranes among the busy road layout.

New and Revised Codes and Standards

(from BSI Updates February & March 2007)

BS EN PUBLICATIONS

The following are British Standard implementations of the English language versions of European Standards (ENs). BSI has an obligation to publish all ENs and to withdraw any conflicting British Standards or parts of British Standard. This has led to a series of standards, BS ENs using the EN number.

***Note:** The date referenced in the identifier is the date of the European standard.*

BS EN 1337:-
Structural bearings

BS EN 1337-2:2004
Sliding elements
Supersedes BS EN 1337-2:2001 which is withdrawn, partially supersedes BS 5400-9.1:1983 and BS 5400-9.2:1983

BS EN 1337-3:2005
Elastomeric bearings
Partially supersedes BS 5400-9.1: 1983 and BS 5400-9.2:1983

BS EN 1337-5:2005
Pot bearings
Partially supersedes BS 5400-9.1: 1983 and BS 5400-9.2:1983

BS EN 1337-7:2004
Spherical and cylindrical PTFE bearings
Supersedes BS EN 1337-7:2001 which is withdrawn, partially supersedes BS 5400-9.1:1983 and BS 5400-9.2:1983

BS EN 1993:-
Eurocode 3. Design of steel structures

BS EN 1993-1:-
General rules

BS EN 1993-1-3:2006
Supplementary rules for cold-formed members and sheeting
Supersedes DD ENV 1993-1-3: 2001 which is withdrawn and partially supersedes BS 5950-5: 1998, BS 5950-6:1995 and BS 5950-9:1994

BS EN 1993-1-4:2006
Supplementary rules for stainless steels
No current standard is superseded

BS EN 1993-1-5:2006
Plated structural elements
Partially supersedes BS 449-2:1969, BS 5400-3:2000 and BS 5950-1:2000

BS EN 1993-1-11:2006
Design of structures with tension components
No current standard is superseded

BRITISH STANDARDS PROPOSED FOR CONFIRMATION

BS 449:-
Specification for the use of structural steel in building

BS 449-2:1969
Metric units

BS 2853:1957
Specification for the design and testing of steel overhead runway beams

BS 5950:-
Structural use of steelwork in building

BS 5950-1:2000
Code of practice for design. Rolled and welded sections

BS 5950-5:1998
Code of practice for design of cold formed thin gauge sections

BS 5950-6:1995
Code of practice for design of light gauge profiled steel sheeting
BS 5950-9:1994
Code of practice for stressed skin design

BRITISH STANDARDS REVIEWED AND CONFIRMED

BS 4604:-
Specification for the use of high strength friction grip bolts in structural steelwork. Metric series
BS 4604-1:1970
General grade
BS 4604-2:1970
Higher grade (parallel shank)
BS 5531:1988
Code of practice for safety in erecting structural frames
BS 5950:-
Structural use of steelwork in building
BS 5950-2:2001
Specification for materials, fabrication and erection. Rolled and welded sections
BS 5950-3.1:1990
Design in composite construction. Code of practice for design of simple and continuous composite beams
BS 5950-4:1994
Code of practice for design of composite slabs with profiled steel sheeting

NEW WORK STARTED

BS 5950:-
Structural use of steelwork in building
BS 5950-3.1:1990/Amendment 1
Design in composite construction. Code of practice for design of simple and continuous beams

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT

07/30143650 DC
BS ISO 4993
Steel and iron castings. Radiographic inspection
07/30143656 DC
BS ISO 11971
Steel and iron castings. Visual examination of surface quality
07/30158903 DC
BS EN 1011-1
Welding. Recommendations for welding of metallic materials. Part 1. General guidance for arc welding

Building with Steel

Steelwork for the cathedral of Maria Assumpta, Nigeria

The history of the building of the cathedral of Maria Assumpta is typical of that so often met with in religious ventures. Construction started as long ago as 1954 since when it has progressed intermittently, chiefly because of lack of funds. Dublin architects were responsible for the general design of the Cathedral and the steelwork was designed in and supplied from Eire. On-site work is being done by local labour. By March 1966 the main part of the building had been completed apart from the roof decking and covering.

The Cathedral, which when completed will seat a congregation of 3,000, in sited in a commanding position at the junction of three roads about a mile from the centre of Owerri in the Port Harcourt area of Nigeria, and is planned in the form of a Greek cross measuring 230 ft by 221 ft with an 88 ft diameter dome at the crossing. Inside the building the arms of the cross span 48 ft 6 in. The dome, 93 ft 6 in high, terminates with an octagonal lantern, the ceiling of which is 101 ft above floor level.

Radiating symmetrically from the centre are four smaller buildings forming a sub cross transforming the main Greek cross into an eight pointed star: two of the buildings house the 28 ft by 22 ft 6 in main side chapels and the other two the public gallery and the choir gallery. Above each of these buildings are twin octagonal belfry towers which form a predominant feature of the external massing, explaining visually the supporting and buttressing system of the dome.

All four main roofs and that of the dome also are to be covered with copper-surfaced felt on timber decking secured to steel trusses through timber purlins. Ceilings will, in general, be finished in hardboard sheeting and exposed parts of the steel trusses finished in plaster.

The Dome

The dome, carried on an 11 ft high steel-framed drum, is constructed with 24 lattice ribs giving a purlin length of about 17 ft by light lattice girders. Domes have a tendency to spin, so to control this movement bracing is provided between two adjacent ribs in four sectors spaced 90 degrees apart. The 24 vertical legs of the drum portion are braced together in all bays and bolted to a ring of steel beams.

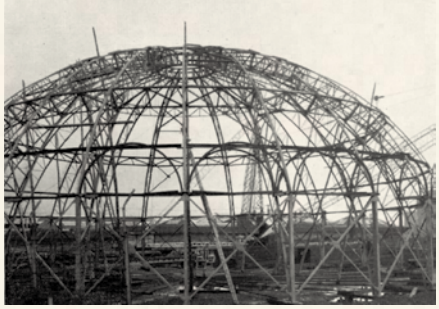
At the top the ribs of the dome connect to a 10 ft diameter ring which is to carry the lantern surmounted with a cross. Outside this ring is another ring, 16 ft diameter, and both are braced together to control deformation of the 10 ft diameter opening. A similar circular bracing system is provided at the level of the tops of the lunettes.

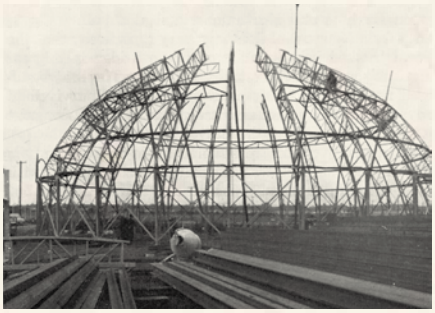
Certain considerations had to be borne in mind when designing the dome steelwork: (1) it was known that the last stage of the journey from Port Harcourt to site was by road over very difficult terrain, (2) erection tackle was limited to one steel mast and (3) scaffolding was scarce.

Bearing these points in mind it was decide that erection should be done by progressively cantilevering the ribs inwards, commencing at bottom level of the dome. The rib section were made in 17 ft lengths with closed ends to prevent damage in transit and facilitate erection: as the weight of the sections did not exceed 4 cwt they could be manhandled without much difficulty. The dome was trial erected before dispatch and this provided an opportunity to check the proposed method of erection.

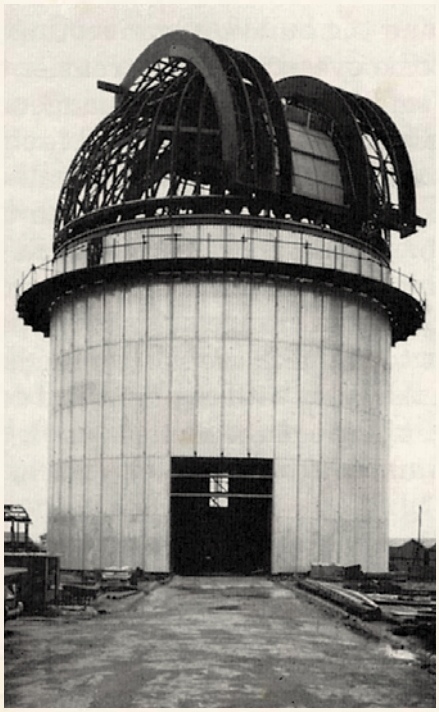
Architects – Hooper and Mayne

Below, left to right: The braced rings for the opening to carry the lantern and cross; Rial erection of the 34¼ tons of steelwork for the dome; The dome was erected by prgressively cantilevering the ribs inwards, as seen in this view taken during trial erection.





The largest telescope in Europe



The Isaac Newton astronomical telescope at the Royal Greenwich Observatory, Herstmonceaux Castle, Sussex, is the largest in Europe. The main mirror is 98 in (2.5m) diameter and 16 in (41cm) thick. Designed by Grubb Parsons the telescope - weighing 100 tons - is housed within an dome which is accurately balanced and levelled on a track 56 ft above ground level.

The building housing the telescope is of steel framed construction, circular in plan of 60 ft diameter and 60 ft high. Steelwork comprises sixteen 18 in by 7½ in by 66 lb universal beam stanchions 55 ft high. Steelwork is grit blasted, zinc sprayed and painted one coat of calcium plumbate.

Floor beams are 36 ft 6 in and 48 ft levels with a cantilever balcony at 48 ft. This balcony is for the use of observers. Main staircase is of all welded mild steel construction. The building is clad with aluminium sheet. Heavy steel reinforcing rods contributed to the great strength needed in the concrete foundation to support the weight of the telescope and its ancillary equipment.

Superintending civil engineer, D H Little OBE BSc MICE Ministry of Public Building and Works.

AD 310
Staircases with flat stringers

The Advisory Desk is sometimes called by engineers who have been asked to justify the flat stringers in staircases, but cannot see how this can be done. This AD explains the phenomena involved and gives guidance on calculations for stability of the stringers. A typical staircase is shown in Figure 1.

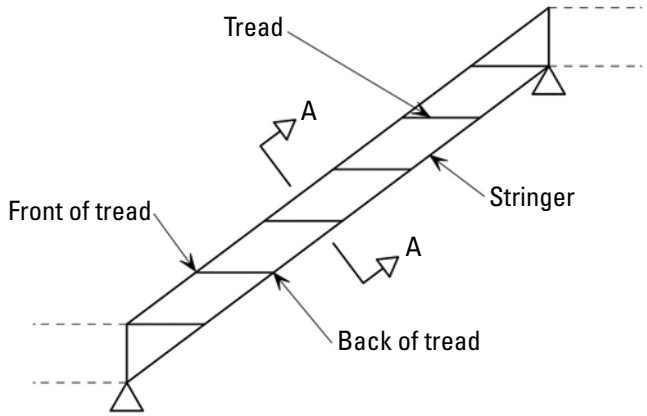


Figure 1: Typical staircase

The main problem that is encountered is the calculation of the buckling of the stringers due to bending. The slenderness λ_{LT} of the stringers can be calculated using BS 59501 Annex B clause B.2.7. However, when the span of the stringers is used, the slenderness is so great that the capacity is too low to support the loaded staircase.

The calculation described above is appropriate for calculating the slenderness of an unrestrained flat undergoing lateral torsional buckling in the mode shown in Figure 2. The deflected form caused by the buckling is shown for a cross-section of the stringer in Figure 3. This shows that the top edge of the stringer, which is in compression, deflects laterally more than the bottom edge, which is in tension. The use of the total length of the stringer to calculate the slenderness has ignored the effect of the treads.

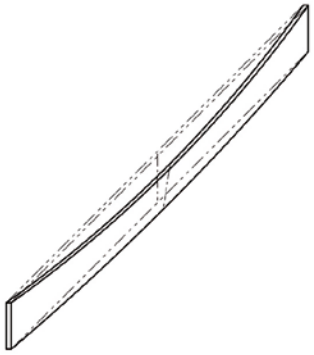


Figure 2: Lateral torsional buckling mode deflecting over the full length

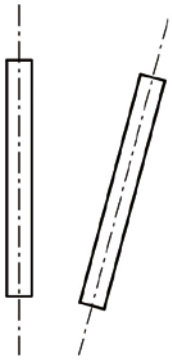


Figure 3: Displacement of stringer cross-section A-A due to lateral torsional buckling

In the staircase shown in Figure 1, the treads are fixed into the stringers near the top edge at the front of the tread and near the bottom edge at the back of the tread. If the tread is rigid in plane (for example a solid plate, not open mesh flooring) and the connection from the tread into the stringer is reasonably stiff, the stiffness of the tread prevents the buckling mode shown in Figure 2 from developing. This is because the tension edge of the stringer does not want to deflect laterally, because the tension pulls it straight. The compression edge wants to buckle laterally, but the in-plane stiffness of the tread and the major axis stiffness of the stringers prevent it from deflecting more than the tension edge. Therefore the compression edge and the tension edge are in neutral equilibrium for the case of buckling on the overall length of the stringers. Therefore the buckling mode of the stringer caused by bending will be as shown in Figure 4. In this case the slenderness for lateral torsional buckling λ_{LT} is best estimated by using B.2.7 with the length taken as the distance between fixings of the treads into the compression (top) edge of the stringer, as shown in Figure 5.

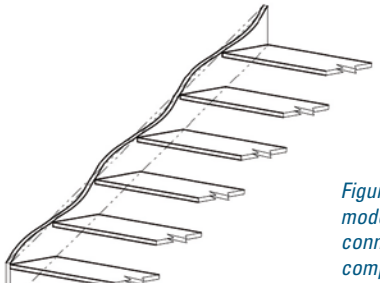


Figure 4: Lateral torsional buckling mode restricted by treads connecting the tension edge to the compression edge

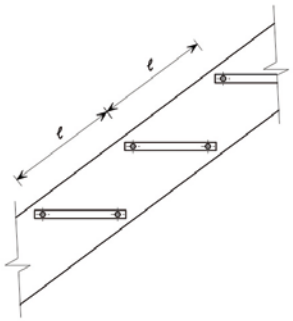


Figure 5: Distance between fixings of the treads into the compression edge of the stringer

The further the tread fixings are from the top and bottom edges of the stringer and the greater the flexibility of the treads and fixings, the more the slenderness λ_{LT} will approach the slenderness of the buckling mode shown in Figure 2.

The forces and moments resisted by stringers are complex. They include vertical bending, and some small lateral bending because walking delivers some small lateral loads. There is also an axial load because the stringer is on a slope. This axial load can be tensile, so not destabilising, provided the structure above the flight of stairs can resist this load. If this is not possible, then the resistance to the axial compression together with the bending moments should be checked.

The stringers can then be checked for resistance to lateral torsional buckling as follows:

1. *Check the staircase has geometry and tread form which will cause buckling as Figure 4*
2. *Take the stringer as Class 3*
3. *Calculate λ_{LT} using B.2.7 with the length shown in Figure 5, using the effective length factor of 1.0, and β_w for Class 3 (Z_x/S_x = 2/3 for a flat)*
4. *Calculate $M_b = p_b Z_x$ as 4.3.6.4*

It is wise to attach the treads to the stringers close to the compression edge and the tension edge for stability of the stringers. It is generally unwise to be too clever in reducing the sizes of staircase components because the behaviour is complex and the lighter the structure the more susceptible it is to vibrations.

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BCSA is the national organisation for the steel construction industry. Details of BCSA membership and services can be obtained from Gillian Mitchell MBE, Deputy Directory General, BCSA, 4 Whitehall Court, London SW1A 2ES
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KEY

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- **C** Heavy industrial plant structures
- **D** High rise buildings
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- **M** Frames for machinery, supports for conveyors, ladders and catwalks
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- **Q3** Lloyd's
- **Q4** Other

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- **4** Up to £2,000,000
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2. Where an asterisk (*) appears against any company's classification number, this indicates that the assets required for this classification are those of the parent company.
- * For details of bridgework subcategories contact Gillian Mitchell at the BCSA.

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16D Bergen Way, Sutton Fields Ind. Est., Hull HU7 0YQ
Tel 01482 838240 Fax 01482 830697

J. ROBERTSON & CO LTD (L M S 9)
Mill Lane, Walton-on-Naze CO14 8PE
Tel 01255 672855 Fax 01255 850487

ROBINSON CONSTRUCTION (C D E F H 1 Q1)
Wincanton Close, Ascot Drive, Industrial Estate, Derby DE24 8NJ
Tel 01332 574711 Fax 01332 861401

ROWECORD ENGINEERING LTD (A B 0 Q1)
Neptune Works, Uskway, Newport, South Wales NP20 2SS
Tel 01633 250511 Fax 01633 253219

ROWEN STRUCTURES LTD (A 1)
Fulwood Road (South), Sutton-in-Ashfield, Notts NG17 2JW
Tel 01623 558558 Fax 01623 440404

S H STRUCTURES LTD
Moor Lane Trading Estate, Sherburn-in-Elmet,
North Yorkshire LS25 6ES
Tel 01977 681931 Fax 01977 681930

SIAC BUTLERS STEEL LTD (C D E F H J N 1 Q4)
Lea Road, Portarlington, Co Laois, Republic of Ireland
Tel 00 353 57 8623305 Fax 00 353 57 8623207

SIAC TETBURY STEEL LTD (D E F H 4 Q1)
London Rd, Tetbury, Gloucs GL8 8HH
Tel 01666 502792 Fax 01666 504246

SELWYN CONSTRUCTION ENGINEERING LTD
Tarron Road, Tarron Industrial Estate,
Moreton, Wirral CH46 4TU
Tel 0151 678 0236 Fax 0151 678 8959

SEVERFIELD-REEVE STRUCTURES LTD (A 0* Q2)
Dalton Airfield Industrial Estate, Dalton,
Thirsk, North Yorkshire YO7 3JN
Tel 01845 577896 Fax 01845 577411

SHIPLEY FABRICATIONS LTD
Maddocks Park, Ancaster, Grantham, Lincs NG32 3PL
Tel 01400 231115 Fax 01400 231220

SNASHALL STEEL FABRICATIONS CO LTD
Pulham Business Park, Pulham, nr Dorchester, Dorset DT2 7DX
Tel 01300 345588 Fax 01300 345533

SOUTH DURHAM STRUCTURES LTD
South Church Enterprise Pk, Dovecot Hill,
Bishop Auckland, Co. Durham DL14 6XR
Tel 01388 777350 Fax 01388 775225

STEEL & ROOFING SYSTEMS LTD
Kilkenny Road, Castlecomer, Co Kilkenny, Republic of Ireland
Tel 00 353 56 444 1855 Fax 00 353 56 444 1860

TAYLOR & RUSSELL LTD
Stonebridge Mill, Longridge PR3 3AQ
Tel 01772 782295 Fax 01772 785341

THE AA GROUP LTD
Priorswood Place, East Pimbo, Skelmersdale, Lancs WN8 9QB
Tel 01695 50123 Fax 01695 50133

THE STEEL PEOPLE LTD
Unit 3E, Priory Park, Mills Road, Aylesford, Kent ME20 7PP
Tel 01622 715900 Fax 01622 715905

TRADITIONAL STRUCTURES LTD (D E F H J K N 5 Q1)
Findel Works, Landywood Lane, Cheslyn Hay,
Walsall, West Midlands WS6 7AJ
Tel 01922 414172 Fax 01922 410211

PADDY WALL & SONS
Waterford Road Business Park,Waterford Road,
New Ross, Co Wexford, Republic of Ireland
Tel 00 353 51 420 515 Fax 00 353 51 420 516

WARLEY CONSTRUCTION COMPANY LTD (F L 7)
Swinborne Road, Burnt Mills Industrial Estate,
Basildon, Essex SS13 1LD
Tel 01268 726060 Fax 01268 725285

WALTER WATSON LTD (Q4)
Greenfield Works, Ballylough Rd, Castlewellan,
Co Down BT31 9JQ
Tel 028 4377 8711 Fax 028 4377 2050

WATSON STEEL STRUCTURES LTD (A B 0* Q1)
PO Box 9, Lostock Lane, Bolton BL6 4BL
Tel 01204 699999 Fax 01204 694543

WESTBURY PARK ENGINEERING LTD
Brook Lane, Westbury, Wilts BA13 4ES
Tel 01373 825500 Fax 01373 825511

WESTOK LTD
Horbury Junction Ind Est, Horbury Junction, Wakefield WF4 5ER
Tel 01924 264121 Fax 01924 280030

JOHN WICKS & SON LTD
Unit 1, Crabbers Cross, Rattery, South Brent, Devon TQ10 9JZ
Tel 01364 72907 Fax 01364 73054

WIG ENGINEERING LTD
Barnfield, Akeman Street, Chesterton, Oxon OX26 1TE
Tel 01869 320515 Fax 01869 320513

H. YOUNG STRUCTURES LTD (C E F H J N 6)
Ayton Road, Wymondham, Norfolk NR18 0RD
Tel 01953 601881 Fax 01953 607842

ASSOCIATE MEMBERS

STRUCTURAL COMPONENTS

ALBION SECTIONS LTD (Q4)
Albion Rd, West Bromwich,West Midlands B70 8BD
Tel 0121 553 1877 Fax 0121 553 5507

AYRSHIRE METAL PRODUCTS (DAVENTRY) LTD (Q2)
Royal Oak Way, Daventry NN11 5NR
Tel 01327 300990 Fax 01327 300885

BARNSHAW PLATE BENDING CENTRE LTD (Q2)
Corporation Rd, Audenshaw,Manchester M34 5LR
Tel 0161 320 9696 Fax 0161 335 0918

CELLBEAM LTD
Unit 516, Thorp Arch Estate, Wetherby, West Yorkshire LS23 7DB
Tel 01937 840614 Fax 01937 840608

COMPOSITE PROFILES UK LTD
15 Moor Road, Broadstone, Dorset BH18 8AZ
Tel 01202 659237 Fax 01202 659288

CORUS PANELS & PROFILES (Q1)
Severn Drive, Tewkesbury Business Park,
Tewksbury, Glos GL20 8TX
Tel 01684 856600 Fax 01684 856601

FLI PRODUCTS
Waterwells Drive, Waterwells Business Park,
Gloucester GL2 2AA
Tel 01452 722200 Fax 01452 722244

FABSEC LTD
1st Floor, Unit 3, Calder Close,
Calder Business Park, Wakefield WF4 3BA
Tel 0845 094 2530 Fax 0845 094 2533

HI-SPAN LTD
Ayton Rd, Wymondham NR18 0RD
Tel 01953 603081 Fax 01953 607842

INTELLIGENT ENGINEERING (UK) LTD
Shire House, West Common, Gerrards Cross, Bucks SL9 7QN
Tel 01753 890575 Fax 01753 899056

KINGSPAN METL-CON LTD (Q4)
Sherburn, Malton, N. Yorkshire YO17 8PQ
Tel 01944 712000 Fax 01944 710555

RICHARD LEES STEEL DECKING LTD
Moor Farm Rd West, The Airfield, Ashbourne,
Derbyshire DE6 1HD
Tel 01335 300999 Fax 01335 300888

MSW STRUCTURAL FLOOR SYSTEMS
Acton Grove, Long Eaton, Nottingham NG10 1FY
Tel 0115 946 2316 Fax 0115 946 2278

METSEC PLC (Q2)
Broadwell Rd, Oldbury, West Mids B69 4HE
Tel 0121 601 6000 Fax 0121 601 6181

STRUCTURAL METAL DECKS LTD
The Outlook, Ling Road, Tower Park, Poole, Dorset BH12 4PY
Tel 01202 718898 Fax 01202 714980

STRUCTURAL SECTIONS LTD (Q1)
PO Box 92, Downing St, Smethwick, Warley B66 2PA
Tel 0121 555 1342 Fax 0121 555 1341

STUDWELDERS LTD
Millennium Hse, Severn Link Distribution Centre, Newhouse Farm
Ind Est, Chepstow, Monmouthshire NP16 6UN
Tel 01291 626048 Fax 01291 629979

COMPUTER SOFTWARE

COMPUTER SERVICES CONSULTANTS (UK) LTD
Yeadon House, New St, Pudsey, Leeds, LS28 8AQ
Tel 0113 239 3000 Fax 0113 236 0546

PSYCLE INTERACTIVE LTD
The Stable House, Whitewell, Whitchurch, Shropshire SY13 3AQ
Tel 01948 780120 Fax 08701 640156

RAM INTERNATIONAL (EUROPE) LTD
4 Woodside Place, Glasgow G3 7QF
Tel 0141 353 5168 Fax 0141 353 5112

STEEL PROJECTS UK LTD
Lupton Court, Prospect Court, Ossett, Wakefield WF5 8AF
Tel 01924 282008 Fax 01924 282007

TEKLA (UK) LTD
Tekla House, Cliffe Park Way, Morley, Leeds LS27 0RY
Tel 0113 307 1200 Fax 0113 307 1201

DESIGN SERVICES

ARRO-CAD LTD
Bretby Business Park, Ashby Road,
Bretby, Burton-on-Trent DE15 0YZ
Tel 01283 558206 Fax 01283 558207

DEVELOPMENT DESIGN DETAILING SERVICES LTD
171 Bradshawgate, Bolton, Lancs BL2 1BH
Tel 01204 396606 Fax 01204 396634

STEEL PRODUCERS

CORUS CONSTRUCTION & INDUSTRIAL
Frodingham House, PO Box 1,
Brigg Road, Scunthorpe DN16 1BP
Tel 01724 404040 Fax 01724 404229

CORUS TUBES
PO Box 101, Weldon Rd, Corby, Northants NN17 5UA
Tel 01536 402121

MANUFACTURING EQUIPMENT

FICEP (UK) LTD
10 The Courtyards, Victoria Park, Victoria Road, Leeds LS14 2LB
Tel 0113 265 3921 Fax 0113 265 3913

KALTENBACH LTD
6-8 Brunel Road, Bedford MK41 9TJ
Tel 01234 213201 Fax 01234 351226

PEDDINGHAUS CORPORATION UK LTD
Unit 6, Queensway Link, Stafford Park 17, Telford TF3 3DN
Tel 01952 200377 Fax 01952 292877

RÖSLER UK
Unity Grove, Knowsley Business Park,
Prescot, Merseyside L34 9GT
Tel 0151 482 0444 Fax 0151 482 4444

VOORTMAN UK LTD
Unit 5, Mercian Park, Felspar Rd,
Amington Rd, Tamworth B77 4DP
Tel 01827 63300 Fax 01827 65565

PROTECTIVE SYSTEMS

FORWARD PROTECTIVE COATINGS LTD
Vernon St., Shirebrook, Mansfield, Notts NG20 8SS
Tel 01623 748323 Fax 01623 748730

INTERNATIONAL PAINT LTD
Protective Coatings, Stoneygate Lane,
Felling, Gateshead NE10 0JY
Tel 0191 469 6111 Fax 0191 495 0676

LEIGH'S PAINTS
Tower Works, Kestor Street, Bolton BL2 2AL
Tel 01204 521771 Fax 01204 382115

PPG PROTECTIVE & MARINE COATINGS
Micro House, Station Approach, Wood Street North,
Alfreton, Derbyshire DE55 7JR
Tel: 01773 837300 Fax: 01773 837302

SIGMAKALON MARINE & PROTECTIVE COATINGS UK LTD
4 Vimy Court, Vimy Road, Leighton Buzzard LU7 1FG
Tel 01525 375234 Fax 01525 378595

SITE COAT SERVICES LTD
Unit 11, Old Wharf Road, Grantham, Lincolnshire NG31 7AA
Tel 01476 577473 Fax 01476 577642

JACK TIGHE LTD
Kirk Sandall Ind. Est., Kirk Sandall, Doncaster DN3 1QR
Tel 01302 880360 Fax 01302 880370

WEDGE GROUP GALVANIZING
c/o Worksop Galvanizing Claylands Avenue,
Worksop, Notts S81 7BQ
Tel 01909 486384 Fax 01909 482540

WELLS PROTECTIVE COATINGS LTD
Unit 21, Wright Business Park, Carr Hill, Doncaster DN4 8DE
Tel 01302 733611 Fax 01302 733639

SAFETY SYSTEMS

COMBISAFE INTERNATIONAL LTD
Unit 1, Zone A, Cheaney Drive, Grange Park,
Northampton NN4 5FB
Tel 01604 660600 Fax 01604 662960

EASI-EDGE
Ollerton Rd, Tuxford, Newark, Notts NG22 0PQ
Tel 01777 870901 Fax 01777 872047

STEEL STOCKHOLDERS

ADVANCED STEEL SERVICES LTD
South Ribble Industrial Estate, Capitol Way,
Preston, Lancs PR5 4AJ
Tel 01772 259822 Fax 01772 259561

ALTERNATIVE STEEL CO LTD
Dobson Park Way, Ince, Wigan WN2 2DY
Tel 01942 610601 Fax 01942 821999

ASD METAL SERVICES – EDINBURGH
24 South Gyle Crescent, Edinburgh EH12 9EB
Tel 0131 459 3200 Fax 0131 459 3266

ASD METAL SERVICES – BODMIN
Unit 13, Cooksland Ind. Est., Bodmin, Cornwall PL31 2PZ
Tel 01208 77066 Fax 01208 77416

ASD METAL SERVICES – LONDON
Thames Wharf, Dock Road, London E16 1AF
Tel 020 7476 9444 Fax 020 7476 0239

ASD METAL SERVICES – CARLISLE
Unit C, Earls Way, Kingsmoor Park Central,
Kingstown, Cumbria CA6 4SE
Tel 01228 674766 Fax 01228 674197

ASD METAL SERVICES – HULL
Gibson Lane, Melton, North Ferriby, E. Yorkshire HU14 3HX
Tel 01482 633360 Fax 01482 633370

ASD METAL SERVICES – GRIMSBY
Estate Road No. 5, South Humberside Industrial Estate,
Grimsby DN31 2TX
Tel 01472 353851 Fax 01472 240028

ASD METAL SERVICES – BIDDULPH
PO Box 2, Tunstall Road, Biddulph, Stoke-on-Trent, Staffs ST8 6JZ
Tel 01782 515152 Fax 01782 522240

ASD METAL SERVICES – DURHAM
Drum Road, Drum Industrial Estate,
Chester-le-Street, Co. Durham DH2 1ST
Tel 0191 492 2322 Fax 0191 410 0126

ASD METAL SERVICES – CARDIFF
East Moors Road, Cardiff CF1 5SP
Tel 029 2046 0622 Fax 029 2049 0105

ASD METAL SERVICES – STALBRIDGE
Station Rd, Stalbridge, Dorset DT10 2RW
Tel 01963 362646 Fax 01963 363260

ASD METAL SERVICES – NORFOLK
Hamlin Way, Kings Lynn, Norfolk PE30 4LQ
Tel 01553 761431 Fax 01553 692394

ASD METAL SERVICES – EXETER
Sidmouth Road, Clyst St Mary, Exeter EX5 1AD
Tel 01395 233366 Fax 01395 233367

ASD METAL SERVICES – DAVENTRY
Royal Oak Ind. Est., Daventry, Northants NN11 5QQ
Tel 01327 876021 Fax 01327 87612

ASD METAL SERVICES – TIVIDALE
Tipton Road, Tividale, Oldbury, West Midlands B69 3HU
Tel 0121 520 1231 Fax 0121 520 5664

AUSTIN TRUMANNS STEEL LTD
Moss Lane, Walkden, Manchester M28 5NH
Tel 0161 790 4821 Fax 0161 799 0411

BARRETT STEEL SERVICES LTD
Barrett House, Cutler Heights Lane,
Dudley Hill, Bradford BD4 9HU
Tel 01274 682281 Fax 01274 651205

BROWN MCFARLANE LTD
Ladywell Works, New Century Street, Hanley,
Stoke-on-Trent ST1 5QH
Tel 01782 289909 Fax 01782 289804

CELTIC STEEL SERVICES
Caerphilly Road, Ystrad Mynach, Mid Glamorgan CF82 6EP
Tel 01443 812181 Fax 01443 812558

CORUS BELLSHILL
Mossend Engineering Works, Unthank Road, Bellshill,
North Lanarkshire ML4 1DJ
Tel. 01698 748424. Fax 01698 747191

CORUS BLACKBURN
Unit 5, Walker Road, Blackamoor Road,
Guide, Blackburn BB1 2QE
Tel 01254 55161 Fax 01254 670836

CORUS BRISTOL
Badminton Rd Trading Est., Yate,Bristol BS37 5JU
Tel 01454 315314 Fax 01454 325181

CORUS DARTFORD
Farnigham Road Station, South Darenth,nr Dartford DA4 9LD
Tel 01322 227272 Fax 01322 864893

CORUS NEWCASTLE
Chainbridge Road Industrial Estate,
Blaydon-on-Tyne, Tyne & Wear NE21 5SS
Tel 0191 414 2121 Fax 0191 414 2210

CORUS STOURTON
Wakefield Rd, Stourton, Leeds LS10 1AY
Tel 0113 276 0660 Fax 0113 272 4418

CORUS WEDNESFIELD
The Steelpark, Steelpark Way, Wednesfield,
Wolverhampton WV11 3BR
Tel 01902 484000 Fax 01902 484288

LASERTUBE CUTTING
Unit 8, Autobase Industrial Estate, Tipton Road,
Tividale, West Midlands B69 3HU
Tel 0121 601 5000 Fax 0121 601 5001

NATIONAL TUBE STOCKHOLDERS LTD
Dalton Industrial Estate, Dalton, Thirsk, North Yorkshire YO7 3HE
Tel 01845 577440 Fax 01845 577165

NEWTON STEEL STOCK LTD
Landshire Lane, Gibbs Marsh Trading Estate,
Henstridge, Somerset BA8 0TN
Tel 01963 365028 Fax 01963 365034

PORTWAY STEEL SERVICES
The Stables, Brook Farm, Westerleigh, Bristol BS37 8QH
Tel 01454 311442 Fax 01454 311445

RAINHAM STEEL CO LTD
Kathryn House, Manor Way, Rainham, Essex RM13 8RE
Tel 01708 522311 Fax 01708 559024

SOUTH PARK STEEL SERVICES
Thomson House, Faraday Street
Birchwood Park, Warrington WA3 6GA
Tel 01925 817000 Fax 01925 818844

SOUTH PARK STEEL SERVICES
South Park Road, South Park Industrial Estate,
Scunthorpe DN17 2BY
Tel 01724 810810 Fax 01724 810081

STEELSTOCK (BURTON ON TRENT) LTD
Ryder Close, Cadley Hill Road, Swadlincote, Derbyshire DE11 9EU
Tel 01283 226161 Fax 01283 550406

STRUTHERS & CARTER LTD
Erimus Works, Valletta Street, Hedon Road, Hull HU9 5NU
Tel 01482 795171 Fax 01482 786186

STRUCTURAL FASTENERS

ANDREWS FASTENERS LTD
Latchmore Park, Latchmore Road, Leeds LS12 6DN
Tel 0113 246 9992 Fax 0113 243 6463

BAPP GROUP LTD
Unit 15, Darton Business Park, Darton,
Barnsley, South Yorkshire S75 5NQ
Tel 01226 383824 Fax 01226 390004

COOPER & TURNER LTD
Sheffield Road, Sheffield S9 1RS
Tel 0114 256 0057 Fax 0114 244 5529

LINDAPTER INTERNATIONAL
Lindsay House, Brackenbeck Road, Bradford BD7 2NF
Tel 01274 521444 Fax 01274 521130

TENSION CONTROL BOLTS LTD
Whitchurch Business Park, Shakespeare Way,
Whitchurch, Shropshire SY13 1LJ
Tel 01948 667700 Fax 01948 667744

CORPORATE MEMBERS

BALFOUR BEATTY POWER NETWORKS LTD
Tel 01332 661491

GRIFFITHS & ARMOUR
Tel 0151 236 5656

HIGHWAYS AGENCY
Tel 08457 504030

ROGER POPE ASSOCIATES
Tel 01752 263636

The Register of Qualified Steelwork Contractors

BUILDINGS SCHEME

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

A All forms of steelwork (C-N inclusive)
C Heavy industrial plant structures
D High rise buildings
E Large span portals
F Medium/small span portals and medium rise buildings
H Large span trusswork
J Major tubular steelwork
K Towers
L Architectural metalwork
M Frames for machinery, supports for conveyors, ladders and catwalks
N Grandstands and stadia
S Small fabrications

Company Name	Telephone	A	C	D	E	F	H	J	K	L	M	N	S	QA	Contract Value (1)
ACL Structures Ltd	01258 456051				●	●	●				●				Up to £2,000,000
Advanced Fabrications Poyle Ltd	01753 531116					●	●	●	●	●	●			●	Up to £400,000
Allslade PLC	023 9266 7531				●	●	●			●					Up to £4,000,000
Atlas Ward Structures Ltd	01944 710421	●	●	●	●	●	●	●	●	●	●			●	Up to £6,000,000*
B D Structures Ltd	01942 817770			●	●	●	●								Up to £1,400,000*
B & K Steelwork Fabrications Ltd	01773 853400		●		●	●	●	●	●		●			●	Up to £4,000,000*
A C Bacon Engineering Ltd	01953 850611				●	●	●								Up to £800,000
Ballykine Structural Engineers Ltd	028 9756 2560				●	●	●	●				●		●	Up to £2,000,000
Barrett Steel Buildings Ltd	01274 266800				●	●	●							●	Up to £6,000,000
Billington Structures Ltd	01226 340666	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000
Bison Structures Ltd	01666 502792			●	●	●	●							●	Up to £2,000,000
Border Steelwork Structures Ltd	01228 548744		●		●	●	●					●			Up to £1,400,000
Bourne Steel Ltd	01202 746666	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000
Brooksby Engineering	01707 872655					●		●	●	●	●				Up to £200,000
Butterley Ltd	01773 573573	●	●	●	●	●	●	●	●	●	●	●		●	Up to £3,000,000*
Cairnhill Structures Ltd	01236 449393		●			●	●	●		●	●			●	Up to £1,400,000*
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000*
Compass Engineering Ltd	01226 298388		●		●	●	●		●						Up to £2,000,000
Conder Stuctures Ltd	01283 545377			●	●	●	●							●	Up to £6,000,000
Leonard Cooper Ltd	0113 270 5441		●			●	●		●		●			●	Up to £800,000
Costruzioni Cimolai Armando SpA	01223 350876	●	●	●	●	●	●	●	●	●	●	●		●	Up to £6,000,000
Curtis Engineering Ltd	01373 462126					●									Up to £800,000
Frank H Dale Ltd	01568 612212			●	●	●								●	Up to £6,000,000
EAGLE Structural Ltd	01507 450081				●	●	●	●	●	●					Up to £400,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●		●					●	Up to £4,000,000
Emmett Fabrications Ltd	01274 597484				●	●	●								Up to £800,000
EvadX Ltd	01745 336413				●	●	●	●		●	●	●		●	Up to £1,400,000
Fairfield-Mabey Ltd	01291 623801	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000*
Fisher Engineering Ltd	028 6638 8521	●	●	●	●	●	●	●	●	●	●	●		●	Up to £6,000,000
Glentworth Fabrications Ltd	0118 977 2088					●	●	●	●	●	●	●			Up to £2,000,000
Graham Wood Structural Ltd	01903 755991	●	●	●	●	●	●	●	●	●	●	●			Up to £6,000,000
D A Green & Sons Ltd	01406 370585				●	●	●	●				●		●	Up to £3,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456		●		●	●	●	●	●	●	●			●	Up to £6,000,000
James Bros (Hamworthy) Ltd	01202 673815				●	●	●	●				●		●	Up to £2,000,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●					●			Up to £6,000,000*
Meldan Fabrications Ltd	01652 632075		●		●	●	●	●	●		●			●	Up to £4,000,000
Mifflin Construction Ltd	01568 613311			●	●	●	●				●				Up to £2,000,000
Normanby Wefco Ltd	01427 611000		●				●	●	●		●			●	Up to £800,000
Nusteel Structures Ltd	01303 268112						●	●	●	●				●	Up to £2,000,000*
Oswestry Industrial Buildings Ltd	01691 661596				●	●	●		●		●				Up to £400,000
RSL (South West) Ltd	01460 67373				●	●	●				●				Up to £800,000
John Reid & Sons (Strucsteel) Ltd	01202 483333	●	●	●	●	●	●	●	●	●	●	●			Up to £6,000,000
J Robertson & Co Ltd	01255 672855									●	●		●		Up to £100,000
Robinson Construction	01332 574711		●	●	●	●	●							●	Up to £6,000,000
Roll Formed Fabrications Ltd	028 7963 1631				●	●	●	●		●	●	●		●	Up to £800,000
Rowecord Engineering Ltd	01633 250511	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000
Rowen Structures Ltd	01623 558558	●	●	●	●	●	●	●	●	●	●	●			Up to £6,000,000
SIAC Butlers Steel Ltd	00 353 502 23305		●	●	●	●	●	●				●		●	Up to £6,000,000
Severfield-Reeve Structures Ltd	01845 577896	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000*
Henry Smith (Constructional Engineers) Ltd	01606 592121		●	●	●	●	●	●							Up to £2,000,000
Traditional Structures Ltd	01922 414172			●	●	●	●	●	●			●		●	Up to £1,400,000
Warley Construction Company Ltd	01268 726020				●					●					Up to £400,000
Watson Steel Structures Ltd	01204 699999	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000*
Webcox Engineering Ltd	01249 813225				●	●	●				●				Up to £400,000
H Young Structures Ltd	01953 601881		●		●	●	●	●				●			Up to £800,000

Notes (') Contracts which are primarily steel but which may include associated works. The steelwork contract for which a company is pre-qualified for 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.

RQSC
The Register of Qualified Steelwork Contractors Scheme

BRIDGEWORKS SCHEME

Based on evidence from the company's resources and portfolio of experience, the Subcategories that can be awarded are as follows:

FG Footbridges and sign gantries
PT Plate girders [>900mm deep], trusswork [>20m long]
BA Stiffened complex platework in decks, box girders, arch boxes.
CM Cable stayed bridges, suspension bridges, other major structures [>100m]
MB Moving bridges
RF Bridge refurbishment
X Unclassified

Applicants may be registered in more than one sub-category.

Company Name	Telephone	FG	PT	BA	CM	MB	RF	X	Contract Value (1)
Allerton Engineering Ltd	01609 774471	●	●	●	●	●	●		Up to £1,400,000*
Briton Fabricators Ltd	0115 963 2901	●	●	●			●		Up to £800,000
Butterley Ltd	01773 573573	●	●	●	●	●	●		Up to £3,000,000*
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●		Above £6,000,000*
Costruzioni Cimolai Armando SpA	01223 350876	●	●	●	●	●			Up to £6,000,000
Fairfield-Mabey Ltd	01291 623801	●	●	●	●	●	●		Above £6,000,000*
Harland & Wolff Heavy Industries Ltd	028 9045 8456	●	●	●	●		●		Up to £6,000,000
Interserve Project Services Ltd	0121 344 4888						●		Above £6,000,000
Interserve Project Services Ltd	020 8311 5500		●	●		●	●		Up to £400,000*
Meldan Fabrications Ltd	01652 632075	●	●	●	●	●	●		Up to £4,000,000
'N' Class Fabrication Ltd	01733 558989	●	●	●		●	●		Up to £1,400,000
Normanby Wefco Ltd	01427 611000	●	●	●			●		Up to £800,000
Nusteel Structures Ltd	01303 268112	●	●	●	●				Up to £2,000,000*
P C Richardson & Co (Middlesbrough) Ltd	01946 727119	●					●		Up to £6,000,000
Rowecord Engineering Ltd	01633 250511	●	●	●	●	●	●		Above £6,000,000
Taylor & Sons Ltd	029 2034 4556	●	●	●	●	●	●		Up to £800,000
Watson Steel Structures Ltd	01204 699999	●	●	●	●	●	●		Above £6,000,000*

Notes (') Contracts which are primarily steel but which may include associated works. The steelwork contract for which a company is pre-qualified for 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.

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- Corrosion Protection
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- Fire Engineering
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- Steelwork Design
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