OCTOBER 2007 VOL 15 NO 9

NSC

NEW STEEL CONSTRUCTION

www.new-steel-construction.com

Steel shields proton research
Chancery Lane façade retained
Innovative design transforms Dublin docks
Retail tie-in at Royal Windsor

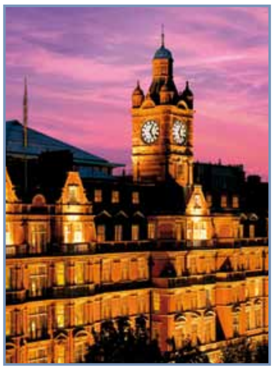
The SCI Annual Dinner

The SCI's prestigious Annual Dinner is once again set to provide an excellent opportunity for guests to socialise with friends and colleagues, renew old contacts and make new ones, in one of the capital's finest hotels, the Landmark London.

The evening will start at 7pm with pre-dinner drinks in the Drawing Room followed by dinner in the Ballroom and conclude with after-dinner drinks.

From left to right:
Gary Richardson,
The Atrium,
The Ballroom,
The Landmark London.



This year's speaker is Garry Richardson, sports presenter on Radio Four's Today programme, Five Live's Sportsweek and regular contributor on BBC TV. He is ranked as one of the country's funniest speakers, with an exceptionally wide range of international sporting contacts and anecdotes for most of them!

This year's dinner will mark the retirement of the current Director, Dr Graham Owens after 22 years with the Institute, and the induction of his successor, Dr Graham Couchman. Please come to say farewell to one Graham and welcome to another!

15th November 2007

The Landmark London,
222 Marylebone Road, London NW1 6JQ

Dress Code: Black Tie

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Structural engineer: White Young Green
Steelwork contractor for building's frame: Severfield-Reeve

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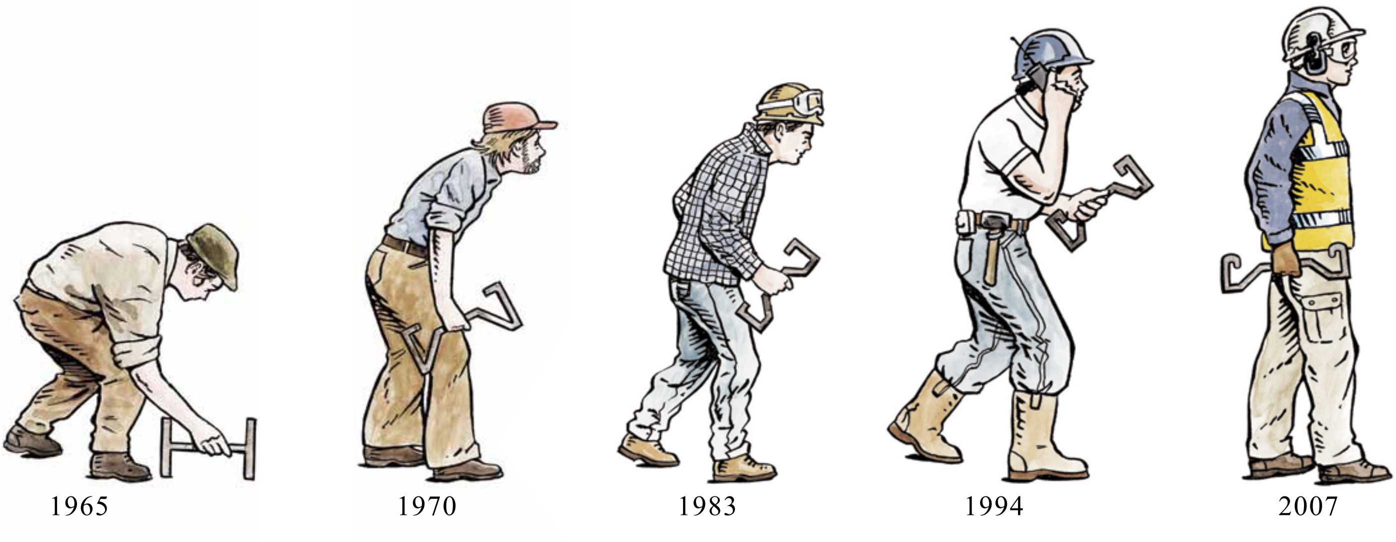
1965
1970
1983
1994
2007

Steel more cost effective than concrete

Nick Barrett - Editor

Good news on the costs front comes from the latest update of the Cost Comparison study that Corus has produced since 1995. The updated study, incorporating prices current in the second quarter of 2007, shows that steel framing solutions are still more cost effective than concrete alternatives. The independently produced study, carried out by Davis Langdon, Arup and MACE, shows that steel frames have been less expensive than concrete alternatives throughout the period since 1995. The competitive gap between the two can be seen progressively widening as steel gets more cost effective and concrete more expensive in real terms for most of the period.

Concrete is 24% more expensive in real terms now than in 1995 whereas steel shows only a 17% increase for the two buildings examined for the study, a 2,600 square metre office in Manchester and an 18,000 square metre prestige office building in central London.

The study shows that the cost gap between steel and concrete based framing systems has barely altered in the past two or three years, after widening in favour of steel over the previous ten years or so. This study is based on a developer's specification for buildings that are of a type actually being built today. Readers of the construction press might remember some misleading advertising earlier this year that suggested concrete was cheaper – but this was due to careful selection of buildings employing a grid that is not in fact a significant part of the market.

The study provides good reason to explain why steel continues to make increases in market share in key areas. The most recent market shares survey earlier this year showed that steel had a 73% share of the market for multi storey commercial buildings.

Having won the cost argument so convincingly over such a prolonged period, the constructional steelwork sector is now turning its attention to demonstrating to clients and designers that steel also has the strongest sustainability case of framing materials. If the long term sustainability advantages of steel were calculated and factored into the cost equation then the case for steel would be even more overwhelming than the market already thinks it is.

Sustainability Charter

The BCSA's Sustainability Charter, which allows members to demonstrate their sustainability credentials to clients, is going from strength to strength. Another two companies have achieved Gold Charter Status, Severfield-Reeve Structures and Richard Lees Decking, with Barnshaw Section Benders achieving Silver status and Concrete and Timber Services achieving Member status. This brings the total number of Charter members to 17.

Those who join up formally declare to embrace a wide range of sustainability promoting policies across their businesses. For example, they agree to operate their businesses in efficient and financially sustainable ways, which benefits clients who value stability in their suppliers. They work to optimise the impact of manufacturing and construction activities on the eco-efficiency of steel construction throughout its life cycle. They work towards increasing the efficiency of use of resources and energy in steel construction by promoting recovery, re-use and recycling of steel.

Many steelwork contractors who have not yet signed up to the Charter can argue that this is how they operate anyway. That is accepted, but you still have to prove your sustainability credentials to a sceptical world. Being a part of the BCSA's Sustainability Charter is one of the best ways to be able to do that.

New standard for fabrication of steel structures

A new European standard for the fabrication of constructional steelwork is being prepared by CEN committee and is expected to be published sometime in 2008. The BCSA is advising companies they need to familiarise themselves with this new standard now.

The standard is called *BS EN 1090-2: Execution of steel structures and aluminium structures - Part 2: Technical requirements for the execution of steel structures.* When published it will immediately replace current standards BS 5950 Part 2 (buildings), BS 5400 Part 6 (bridges) and BS 8100 (towers and masts).

Dr David Moore, BCSA Director of Engineering, said the new standard will introduce a number of issues that are different to the current British Standards for fabrication.

"More responsibility is placed on the steelwork contractor to get it right first time, and more reliance is placed on the knowledge and competence of staff."

BS EN 1090-2 will also be a supporting standard for CE Marking, while it also introduces the concept of Execution Class. "In simple terms Execution Class determines the level of workmanship used to fabricate the structure," explained Dr Moore.

"Four classes are introduced from Class 4 which is the highest quality to Class 1 which is lowest."

The Execution Class can apply to the whole structure, but it can also apply to individual details. A building could be classified as Execution Class 2, but a particular feature, such as a detail subject to fatigue, could be classified as Class 3.

As part of the increase in responsibility, the standard also requires steelwork contractors to have in place a welding quality management system that conforms to the requirements of the relevant part of BS EN 3834.

BS EN 1090-2 will contain two types of tolerances, essential and functional. Both tolerances are mandatory, but essential tolerances are those that are declared as part of the CE Marking.

Cold War museum scoops European Award

Steelwork contractor S.H. Structures was in Luxembourg on 13 September to collect a prestigious European Steel Design Award for The Royal Air Force Museum Cosford's new National Cold War Collection project.

The steel-framed building, designed by Feilden Clegg Bradley Architects, houses a unique collection of historic aircraft and other exhibits relating to the Cold War era.

The awards, which this year received entries from 19 countries, are presented every two years by the European Convention for Constructional Steelwork (ECCS) and acknowledge the creative and outstanding use of steel in architecture and construction.

"This was a great project to work on as we were involved in the early design development of the structure. This collaborative approach, led by the architects, enabled us to influence the design and bring both financial and programme benefits to the scheme," said Tim Burton, S.H. Structures Sales & Marketing Manager.

The £9M project opened to the public during February 2007.

Steel footbridge for Belfast's Westlink

Fisher Engineering has erected a new steel footbridge over Belfast's Westlink motorway to provide pedestrian access between the city centre and the Royal Victoria Hospital.

Part of the on-going Westlink road widening scheme, the bridge is a straight replacement for an older structure which was torn down earlier this year.

The entire steelwork for the 48m-long, 3.4m wide and 3.5m-high bridge was fabricated at Fisher Engineering's Enniskillen facility over a 10 week period, before being erected in one overnight operation.

Using two 200t capacity mobile cranes, the bridge was lifted into position as two fully completed 35t sections. "These two halves were lifted simultaneously and spliced in mid-air before being placed on to their two supporting concrete piers," explained Brian Keys, Project Manager for Fisher Engineering.

The fully enclosed footbridge is made from four tubular 355mm diameter steel beams supporting the floor, with 300mm diameter steel hoops forming the cage-like pedestrian bridge form. Wrapped around the hoops, the structure's sides and roof are entirely clad in a stainless steel mesh.

Fisher Engineering also fabricated, supplied and erected four steel access ramps for the city centre side of the bridge.

Each of the ramps is 30m long and weighs approximately 20t. Similar in form to the bridge, the ramps are not however fully enclosed as they don't have roofs.

After the bridge was installed, Fisher returned to site a few weeks later and erected all of the ramps at the end of September.

New gold members for sustainability charter

Sustainability in Steel Construction

Four new companies have been successfully audited and joined the Steel Construction Sustainability Charter, bringing the total number of members to 17.

Two of the new members, Severfield-Reeve Structures and Richard Lees Decking were awarded Gold status, while Barnshaw Section Benders and Concrete & Timber Services achieved Silver and Member status respectively.

As part of the audit process companies are awarded points, and must score more than six points from a maximum of 12. Their points tally then gains them Charter Status in three levels: Gold, Silver and Member.

The BCSA requires that Sustainability Charter Members should make a formal declaration that consists of the following eight points.

- Operate their businesses in efficient and financially sustainable ways in order to undertake contracts that satisfy clients and add value for stakeholders.
- Work to optimise the impact of manufacturing and construction activities on the eco-efficiency of steel construction through its life cycle.
- Work towards increasing the efficiency of use of resources and energy in steel construction by promoting the recovery, reuse and recycling of steel.
- Foster the health and safety of employees and others in the steel construction industry, and operate generally in a healthy, safe and environmentally sound manner.
- Demonstrate its social responsibility by promoting values and initiatives that show respect for people and communities associated with steel construction.
- Conduct business with high ethical standards in dealings with employees, clients, suppliers and the community.
- Engage stakeholders and independent third parties in constructive dialogue to help implement sustainable development.
- Build on their knowledge of sustainability and willingly share this with others, by being open and active in communications and by helping steel and construction companies and other organisations in the supply chain to implement sustainable policies.

SIAC buys further into UK market

Republic of Ireland based construction firm SIAC has purchased Graham Wood Structural for an undisclosed sum.

The purchase of the Sussex-based steelwork contractor is the firm's second UK purchase in the last 12 months - it bought Bison Structures last year.

Graham Wood has been operational since 1992 and last year its turnover exceeded £17M, while its operating profit margin was between 5% and 10%.

SIAC is among the oldest and biggest Irish construction firms and owns one of the Republic's largest steelwork contractors, SIAC Butlers Steel.

Commenting on the deal Finn Lyden, Chief Executive, SIAC Construction Group, said: "This acquisition complements our existing UK steel fabrication business, SIAC Tetbury Steel, formerly Bison Structures. We believe that our two UK steel fabrication businesses can benefit from synergies with our Irish operation (SIAC Butlers Steel) and are well placed to deliver complex and challenging projects within London and southern Britain.

"As the most logical geographic area for business expansion, we will seek further acquisition opportunities in the UK, but not necessarily in the steel sector."

Spanish hotel for prestigious London site

Rowen Structures is currently erecting steelwork for a Spanish owned five-star hotel on the prominent and prestigious central London intersection of the Strand and Aldwych.

Project architect Foster and Partners, said the building - the first UK venture for the Spanish Silken Hotel Group - will deliver a bold contemporary vision within an historic location, by combining the restoration of the listed facade of Marconi House, with a new Portland stone building and an entirely restructured interior.

The 11-storey scheme comprises restaurants, bars, a rooftop terrace, a 170-bedroom hotel and 90 apartments.

Rowen Structures will erect approximately 2,500t of structural steelwork for the project and is expecting to complete its work by early 2008.

Jeff Matthews, Project Manager for Rowen Structures, said the main challenge for the job is the hotel's dramatic structure-high atrium.

"Triangular in shape, the atrium tapers towards the top and this requires us to install a series of raking columns. We then have some complicated connections from these members to the floor beams."

Rowen is also installing a number of large transfer structures - mostly on levels two and three - to support the upper portions of the building.

The project is scheduled for completion during 2009.

AROUND THE PRESS

New Civil Engineer
23/30 August 2007
Ring leader
City planners have elected to use 2,000t of weathering steel for the structure because it will never have to be painted and its final colour will reflect the area's industrial heritage.

Construction News
30 August 2007
Severfield reveals its plans for Fisher
New Chief Executive Tom Haughey, who formally took over from previous boss John Severs earlier this summer, said the Northern Irish firm would continue to focus on work on both sides of the Irish border.

Construction News
30 August 2007
Boom with a view
A mobile crane manoeuvres Corus Kalzip's Hi-Point roofing system onto a new visitor centre at the top of Mount Snowdon. The system is manufactured off-site then transported to the summit by mountain railway.

Contract Journal
29 August 2007
Ring of steel
Alfred McAlpine Project Services has completed the structural steelwork on the Hunslet Viaduct, part of the £50M Leeds Inner Ring Road. The 13 span, 500m-long viaduct is made up of 1.8m-deep steel beams in a twin ladder beam configuration.

European Foundations
Summer 2007
Stage struck
Reclaimed steel piles are being used to make pier-like platforms to help build the Limerick Tunnel in Ireland.

New web advisory service from the Steel Alliance

The Steel Alliance, a joint venture between SCI and its French counterpart Centre Technique Industriel de la Construction Métallique (CTICM) is launching a new dedicated technical advisory web site on 30 October.

Known as the Steel Alliance e-Advisory Service, it will be available at *www.steel-alliance.org*

The service will operate in English and French and will be open to subscribers on a pay-as-you-go basis. For €240 subscribers will be able to ask up to six questions on any specific technical matter related to steel structures.

"This formula offers great flexibility for users, who only pay for what they need," said Christine Roszykiewicz, Business Manager Steel Alliance.

"Engineers can directly, and in complete confidentiality, address their questions to a team of experts at SCI and CTICM, who include engineers, architects and building physicists with international authority in their field."

The target response time will be one working day and advisory topics will come under the following broad headings: Initial design concepts; Detailed design to the Eurocodes; Fire engineering; and Best practice for construction.

For a limited period, the Anglo-French alliance will be offering a free introductory offer. The service will be directly linked to other web tools dedicated to the Eurocodes such as Access-Steel - Eurocodes made easy at *www.access-steel.com* and SEFIE - the Eurocode discussion forum at *www.sefie.steelbiz.org*

Trusses work for temple roof

Some complex 3D modelling was used by Metsec to help its design of complicated gutter support steelwork on the dome of a new Sikh temple in Birmingham.

The company has supplied long span, pitched and tapered lightweight lattice trusses to support the hipped roof of the Baba Deep Singh Gurdwara in Handsworth and wanted to save valuable time on a difficult project.

Metsec Lattice Joist Division Sales Director Darren Bird, said: "This is an excellent example of how we can bring our technology to bear on a job, and in doing so turn a potentially complex and time consuming project into a much more straightforward one.

"And because we can be up to 50% lighter than traditional hot rolled beams, recent increases in raw material prices have had less impact on us."

The trusses, spanning up to 15m and an 11-degree pitch, were supplied in two halves for ease of handling, and then bolted together on site.

Magnetic handling eases loading

One of the first FICEP Tecno-lift units has been installed at Watson Steel Structures' 19-acre site in Bolton, as part of the firm's on-going programme to increase efficiency and productivity.

FICEP said more and more structural steel fabrication companies are discovering the benefits of Tecno-lift a completely safe and reliable system for the rapid handling of ferrous loads.

The system works on the principle of a permanent electro circuit which offers the power of an electro-magnet combined with the independence of a permanent magnet. The power is only applied for a few seconds to attach the lifting head to the load, which is then safely and securely clamped in position.

The load can be lifted, moved, positioned or suspended as required and it can be released when it is back on the ground, on a machine, truck or racking system.

No battery back-up is required to guard against power cuts and electrical consumption for this type of magnet is 95% less than with normal electro-magnets.

DVD will create safer working environment

The BCSA has collaborated with Ryder Marsh (Safety) to develop a behavioural based safety package, entitled *Protecting our People*, aimed at the steel construction industry. It includes an interactive DVD.

Using Behavioural Based Safety (BBS), the training package and its supporting material has been specifically developed to help managers and supervisors acquire new techniques and improved skills which will enable them to satisfy work safety responsibilities.

"Good safety correlates well with good performance," said BCSA Health & Safety Manager Pete Walker. "Member companies that introduce the BBS will be making a valuable investment."

Modern safety theories firmly place the responsibility for creating a good safety climate upon line managers. Mr Walker said a positive safety climate is not something that can be taken for granted, it has to be managed.

"It is for this reason that managers must strive to extend their safety knowledge and skills in order to achieve high levels of safety in their area of responsibility," added Mr Walker.

BBS is based on techniques that have been tested in many different industries and have proven to have a dramatic effect upon safety related behaviour. It will help change a culture that condones unsafe practices, reacts to accidents and concentrates on statistics, and sees safety as someone else's responsibility to one that observes, identifies and eradicates unsafe acts.

BBS can assist in developing and maintaining good safety performance by being presented in an attractive and entertaining format. The DVD has five self-contained chapters plus an interactive hazard spotting section.

For more information on the training package email: pete.walker@steelconstruction.org

Seven bridges for motorway widening

Rowecord Engineering has fabricated, supplied and erected a total of seven new steel bridges over the M1 motorway, as part of the on-going widening scheme taking place between junctions 6A and 10.

Main contractor Balfour Beatty/Skanska joint venture is widening the motorway to four lanes, with continuous hard shoulders, in both directions on a 17km-long stretch of highway from the M25 through to Luton.

The seven new bridges are all replacement structures and include three accommodation single lane access bridges, two double lane bridges at J10, one double lane structure at Slip End and the four-lane wide Breakspear overpass at J8.

The J8 bridge was the last structure that Rowecord fabricated and erected. This 115m-long bridge was lifted into position in four main sections per span, each weighing 35t.

All of the bridges are supported on mid-carriageway concrete pillars and concrete abutments.

"We lifted all the bridge sections in pairs of braced girders," said Wayne Powlesland, Rowecord Contracts Manager. "This reduces installation time and provides better overall stability."

The erection programme involved a number of nighttime closures of the M1, as well as some rolling block closures. Rowecord estimated that the majority of lifts were completed in six hour possessions.

Feature columns support new university laboratory

Steelwork for the new Digital Laboratory at Warwick University will be completed early this month (October).

Billington Structures will erect a total of 340t of steelwork for the project, much of it exposed for an aesthetic feature element.

The new laboratory will provide a top quality research facility at the University and will bring together, under one roof, a number of units currently scattered around the campus.

Designed around a large central concourse at ground floor level, the three-storey building has an overall footprint of 2,300m^2.

The perimeter columns for the structure are all CHS feature members, predominantly 457mm diameter sections, which extend up to the roof eaves.

Bob King, Billington's Business Development Manager, said the building's design included some large open spans for presentation rooms and lecture theatres. "We

have installed a number of 610mm-deep beams for these areas."

The building will have a steel roof supporting a living sedum covering, which will slow down rainwater run-off as well as providing additional protection to a waterproof membrane.

NEWS IN BRIEF

CSC said its recently launched FabTrol Material Requirements Planning (MRP) software has been developed specifically for the steel construction industry. In a single integrated and scalable solution it incorporates all the key business functions involved in the steel fabrication process including: estimating; drawing management and 3D model imports; project management; material management; and production and shipping management.

The **Environment Agency** has announced that from September in England and Wales steelmaking product blast furnace slag will no longer be classified as a waste but as a by-product.

SCI has been commissioned to draft a proposal for a Russian version of its **www.access-steel.com**, the free online information system for steel and composite construction.

Cartwright Pickard Architects won the UK section of the Living Steel 2nd International Architecture Competition for Sustainable Housing, held in Brussels on 17 September. The competition challenges entrants to design efficient and innovative housing solutions using steel construction to meet the demands of a burgeoning global shortage. Entrants were required to submit designs for one of three locations: Brazil, China and the UK.

Corus has announced a series of lectures, at three venues, on a range of topics relating to steel in construction (see diary page 10). The lectures will run over one evening per week, over a period of six weeks. London and Newcastle will be on Thursday evenings commencing 18 October, and Belfast will be on Tuesdays commencing 16 October. Each evening will consist of two, one hour lectures, presented by speakers from Corus, SCI and Imperial College London.

Former contracts director assumes full control at DGT

Norfolk based steelwork contractor DGT Steel and Cladding has a new owner, former Contracts Director Barry Heyne.

Mr Heyne, 44, has assumed full control of the company, taking the role of Managing Director and Chairman after a buyout of the other existing shareholders.

Founded in 1990, DGT has been based in Lenwade, near Norwich, since 1999 and since then annual turnover has increased from £10M to £27M. This year that figure is expected to increase still further to £32M and the business plan is to grow this to £42M over the next three years.

"This is an exciting time for DGT. The past few years have seen us expand our capabilities on both design and production. We are continuing to invest heavily in the company, not only to safeguard the jobs of our current employees but those of the new apprentices we are recruiting to meet the demands of our growing orders book," said Mr Heyne.

Left to Right: Barry Heyne with DGT employees Matt Byatt, Chartered Engineer, and Mark Bird, Associate Director.

Steelwork complete for cross channel service station

Caunton Engineering has completed the erection of 450t of structural steelwork for the new Stop 24 Motorway Services Station at Junction 11 on the M20 near Folkestone, Kent.

Stop 24 is designed as a new concept in motorway service areas (MSA's) and will concentrate on catering to the cross channel traveller using either the nearby port facilities or tunnel.

Caunton's steelwork comprised a mixed portal frame design with a framework containing a split level twin span with two internal mezzanine floors and a high-level walkway.

The lower level portal comprises of traditional rafters, while the higher level is manufactured from feature tapered plate girder beams and columns.

As part of the overall concept, developer Henry Boot Developments is holding dis-cussions with cross-channel operators with a view to providing real time information on arrivals and departures of the various services.

The main contractor for the £9.2M project, which also includes a road works contract, is Crispin and Borst.

Diary

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

22 October 2007
Design Appreciation Course for Technicians
Cedar Court Hotel, Huddersfield.
£150 + VAT, BCSA members.
£180 + VAT, non BCSA members.

23 October 2007
Steel: The Show 2007
Aztec Hotel, Bristol
Free.

24 October 2007
Steel: The Show 2007
Moor Hall Hotel, Birmingham
Free.

6 November 2007
Steel: The Show 2007
Radisson SAS, Liverpool
Free.

20 November 2007
Steel: The Show 2007
Selsdon Park Hotel, Croydon
Free.

27 November 2007
Steelwork Contractor Designer Course
Cedar Court Hotel, Huddersfield.
£150 + VAT, BCSA members.
£180 + VAT, non BCSA members.

The SCI provide a range of in-house training courses to both Members and Non-Members of the SCI. Courses can be customised to suit a company's CPD objectives.

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CPD Autumn Seminars

Date	*Location*
16 October 2007	Belfast
18 October 2007	London & Newcastle
23 October 2007	Belfast
25 October 2007	London & Newcastle
30 October 2007	Belfast
1 November 2007	London & Newcastle
6 November 2007	Belfast
8 November 2007	London & Newcastle
13 November 2007	Belfast
15 November 2007	London & Newcastle
20 November 2007	Belfast
22 November 2007	London & Newcastle

Topics to include:

Fire engineering	Sustainability
Building envelope	Eurocodes and worked examples
Vibrations	Health and safety
Frame stability	Tubular welded joint design
Framing solutions	Standards essentials

For more details on Corus CPD Seminars contact:
Ken Oliver. T 01709 825584 E ken.oliver@corusgroup.com.
or visit *www.corusconstruction.com/cpdengineers*


BCSA new President Richard Barrett: "The membership is a huge resource".

Son of former BCSA President follows in father's footsteps

Big, bald, very bright, charismatic and canny – these are adjectives used to describe Richard Barrett, incoming President of BCSA. 'His father's son' will also ring bells with older Association members, reports Ty Byrd.

Let us deal with the adjectives first. There is no denying that Richard Barrett is big (he must stand over 1.8m and weigh 100kgs) and bald (the light tends to shine off his shaven head). You only need to talk to him briefly to realise he is an intelligent man knowledgeable about the industry in which he works and – as BCSA President – now serves. (He actually got a double first in engineering at Cambridge.) His character is generous, open, super positive and of a nature that draws people on side. Which leaves just the last of the words listed above to explore: the description canny. Well, he is that, all right, in spades. Particularly in regard to timing.

This year he is 50 and he has 'retired', just as he always promised himself he would, right on target. His business, Barrett Steel Buildings, has been sold to its senior managers (although Richard remains as non executive chairman for two years) following some excellent years of trading and, crucially, with the prospect of more good years to come. He is not married, has no children and selling up was the fundamental element of his succession plan. The time was right for the business to go.

Shrewdness and a sense of timing have marked Richard Barrett's career both before he and his brother James bought the family firm back in the 1990s and since – initially in the use of his own engineering skills to win business, subsequently in aligning his company's skills and credentials to suit its clients' broadening interests, into areas of sustainabilty and least environmental impact. Barrett Steel Buildings was very early into design and build (D&B) and total IT integration; later it was first in its sector to attain ISO 14001 accreditation, first to sign up to BCSA's Sustainability Charter, first to engage in carbon offsetting.

His character is generous, open, super positive and of a nature that draws people on side.

But to discuss this, is to leap ahead with Richard's profile. Going back to the beginning, Richard Barrett was born in west Yorkshire with metal in his blood. The original family business Henry Barrett & Sons owed its origins to his grandfather's grandfather having established himself as an iron merchant in Bradford in 1860s. The company gently prospered over the years, by the late 1970s trading as a steel stockholder and supplier of structural steelwork, of moderate size but good repute. "Despite not being pressured by my father, and ignoring my mother who was desperate for me to take a doctorate, I went straight into the family firm on graduating in 1978," he says.

The economy was stuttering and structural steel was not doing particularly well, but Richard – who at Cambridge had enjoyed economics as much as structural engineering, particularly the commercial interpretation of economic principles – felt sure he could make more of the company. All in good time, thought his father. Year one was spent by young Barrett on the shop floor, year two on site, year three in the drawing office. "It was after this time I began adding value to the company, having

gained an understanding of components and the practical side, which I could marry to a knowledge of engineering principles."

D&B was now something that Henry Barrett could offer, almost alone among steelwork contractors. Markets were sought – sheds were the obvious first target, and almost immediately success came the company's way. "We could be extremely competitive, through D&B getting the design right on the nail to produce just the right structure at least cost but with best margins."

"The general development of D&B within the steel sector has helped make steel become the success it has."

Henry Barrett became the market leader in sheds and looked for other areas to exploit. (Multi storey buildings up to 12 floors, schools, most recently multi storey retail stores for the likes of IKEA: all are being designed and built by Henry Barrett Ltd's successor, see below). "The general development of D&B within the steel sector has helped make steel become the success it has," Richard says now.

He was appointed technical director in 1985 and his influence grew. His father Guy became BCSA President around this time (hence the reference in this article's introduction: Richard is the first son to follow his father into the role), and with Richard and James looking after the structures and steel stock holding sides respectively, the company's profits grew. Henry Barrett & Sons was floated on the Stock Exchange in 1987 and diversified (a process many specialists engaged in at the time) into the likes of plastics, materials handling and curtain walling. Which was to be the company's undoing: recession hit the peripheral companies hard in the early 1990s and the Receiver was called in, in November 1992.

To cut a long story short, with venture capital funding, two new companies eventually emerged from the ashes. These were Barrett Steel Ltd (headed up by James Barrett) and Barrett Steel Buildings Ltd (headed up by Richard). Both have gone like trains: Barrett Steel is now a major stockholder of national significance, handling 400,000t/year, with Barrett Steel Buildings acknowledged as perhaps the most innovative supplier of structural solutions in Britain.

Again, as alluded to above, lateral thinking combined with structural knowledge and an eye for beneficial and social benefit have helped. For instance, Barrett Steel Buildings set out several years ago to discover to what extent a steel framed building could be 'recycled' – well ahead of the rest. The company designed and built in 2005 a building for client ProLogis which had ease of disassembly built in, to aid eventual reuse in the future.

Barrett Steel Buildings was sold in August this year and is now in the ownership of its former senior managers. "There are many good years ahead for the company," believes Richard Barrett. And what will he be doing? As well as his 'hand over' period as non executive chairman of Barrett Steel Buildings, he continues as a director of Barrett Steel and has many other interests, including of course the BCSA. There, sustainability, Eurocodes, steel v. concrete will all figure on his Presidential agenda, as will 'participation'. "The more members are involved, the stronger BCSA is," he says. "The membership is a huge resource, in terms of energy and the potential to get things done, but there are engagement issues to be addressed."

His professional activities will not be allowed to take up all his time. A petrol head, with an Aston Martin and E-type to his name, Richard will probably follow the F1 circus around the world more assiduously than hitherto. Travelling for the sake of it, a great interest of his, will be undertaken but only in short bursts. "My labradors Merlin and Percy appreciate a great deal of attention and we don't like to be parted from each other for long."

Above left: ProLogis' Barrett Steel Buildings designed structure – built with disassembly in mind.

Above: Looking forward to 'retirement': Richard Barrett is going to have a good time.

The fortress of steel

Five metre thick internal walls encasing a proton beam and target, and a steel frame incorporating a floor loading of 50t per square metre contributed to an extraordinary steel tonnage for a new scientific laboratory in Didcot. Martin Cooper reports.

Deep in the south Oxfordshire countryside scientists are awaiting the completion of a steel structure quite unlike any other in the UK. The ISIS Target Station 2 at the Appleton Rutherford Laboratories represents one of the largest-ever UK government funded scientific projects and it will house an array of research equipment which needs to be surrounded by 5m thick steel and concrete walls in order to contain radiation.

The project can actually be described as a steel structure within a steel structure. Sheltering the equipment and research area, the building comprises a large steel shed-like structure, which although erected in a traditional method, contains nearly twice the amount of steel required for a normal commercial building of the same size.

"There is more than 28,000t of steel used inside the structure," says Jonathan Carkeet, ISIS Installation Manager. "Because of this we have a floor loading of 50t per square metre, which is incredible."

Consequently, to take this into account steelwork contractor Severfield-Reeve erected the building's main frame using predominantly large 916 x 419 columns, which helped the overall steel tonnage reach 1,600t for the external frame's steelwork.

Arthur Rowell, White Young Green's Project Engineer, explains the building's frame may look like an ordinary shed but it had to support three internal overhead cranes, plant rooms at roof level and a lot of services, all of which added to the overall structural loading.

"The client wanted some clear open spans and to provide this we had to use some large main columns spaced at 13m centres. The building has three spans, the widest of which is 30m, so to carry services over this area we then needed a lot of supporting steelwork."

But it is inside the structure where the majority of the project's steel has been installed. This is to shield and encase a proton beam within a 143m-long tunnel and a tungsten target inside a structure known as the 'Monolith'.

"It's a massive undertaking and one that will have huge benefits for science."

In summary, once the facility is up and running a proton beam will be fired down the tunnel at a tungsten target to produce neutrons which are then used in materials experiments. There is a very real chance of radiation leakage and so the tunnel and monolith are both clad in steel slab and concrete to prevent this.

Approximately 23,000t of steel has been placed around the beam's tunnel as a protection against radiation. Incidentally, the beam itself originates

FACT FILE
ISIS Target Station 2, Didcot, Oxfordshire
Main client: *Rutherford Appleton Laboratories*
Architect: *Anshen Dyer*
Structural engineer: *White Young Green*
Shell and core contractor: *Costain*
Steelwork contractor for building's frame: *Severfield-Reeve*
Installation steelwork team: *ISIS and Corus Northern Engineering Services*
Project value: *£140M*
Steel tonnage: *32,000t*

The frame housing the research facility had to take into account extra loading and consequently required 1,600t of steelwork.

Nearly 5,000t of steel slabs are placed around the monolith to prevent radiation leakage.

from the existing ISIS spallation facility which is located adjacent to the new building. To connect the tunnel to the source of the proton beam, the tunnel had to be bored through an existing 8m-thick concrete wall.

The tunnel's shell consists of five layers of steel for the roof and seven layers for the walls. Each layer is a steel slab, which weighs 25t and is approximately 1m thick. They were lifted into position by the facilities in-house overhead electric cranes as well as vacuum lifting equipment.

"All the slabs of steel fit together like a giant jigsaw and because the tunnel has a 45-degree bend in it, most are a slightly different shape'" comments Mr Carkeet.

At the end of the tunnel is the shielding monolith which houses the target. This structure is 12m in diameter and 7m tall, and comprises of nearly 5,000t of low manganese low cobalt steel, which was used in order to mitigate radiation problems. A further 1,000t of steel has been placed below the Monolith to shield ground water from radiation.

"There is more than 28,000t of steel used inside the structure"

"The steel used for the foundation protection was from an old building on the site," explains Dr Martyn Bull of the ISIS Communications Group. "It had been exposed to low levels of radiation in the past so re-using it for this project was a suitable and sustainable solution."

Corus Northern Engineering Services (CNES) designed and delivered the tunnel shielding and the

Below: The steel encased tunnel leads directly into the monolith.

Right: Nearly 1,000 individual steel slabs have been placed in a vast jigsaw arrangement to form the monolith.

monolith, as well as undertaking a complete trial erection of the monolith structure prior to delivery.

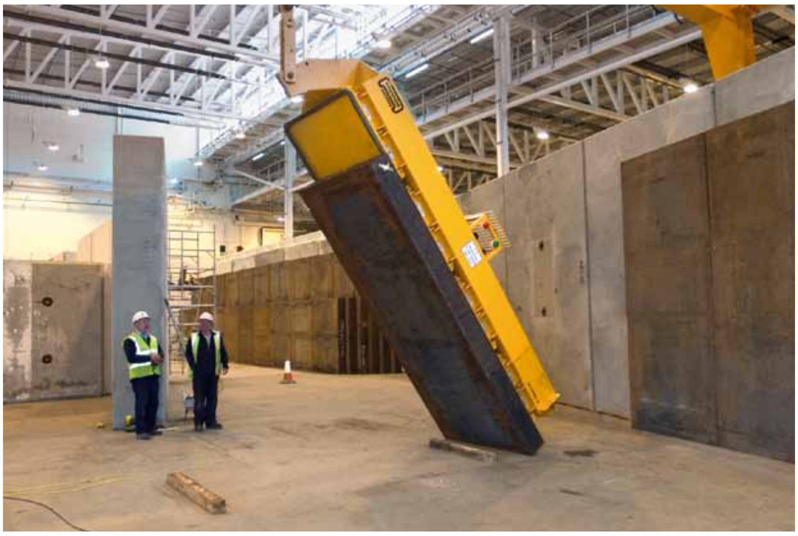
"The Monolith is a complex 3D jigsaw of accurately machined pieces," comments CNES Project Manager, Dave Gallagher. "The degree of complexity is such because there are exit and entrance channels for the beam, along with 18 ports through which instruments monitor the tests."

"The Monolith is a complex 3D jigsaw of accurately machined pieces."

CNES built the outer bulk shielding using profiled, flame cut slab or plate layered in an alternating, interlocking brick pattern. They flame cut and machined it as required to ensure structural integrity and stability, and to meet the dimensional requirements. The monolith needed nearly 1,000 interlinked steel building bricks, a third of which were made from castings and two thirds from profile cut steel slab.

Summing up the construction process, Mr Carkeet says the major difference between this project and any other is the influence of science. "The specifications of the job are extraordinary, especially the steelwork. It's a massive undertaking and one that will have huge benefits for science."

The first proton beam to target is scheduled to take place this month (October), but the entire installation will only be complete in early 2008, with the start of the full experimental programme due in October 2008.



Above right: Vacuum lifting equipment was used to place the huge steel slabs.
Right: The new building is set in a large landscaped area which required a huge earthmoving programme.

What's going on inside the monolith?

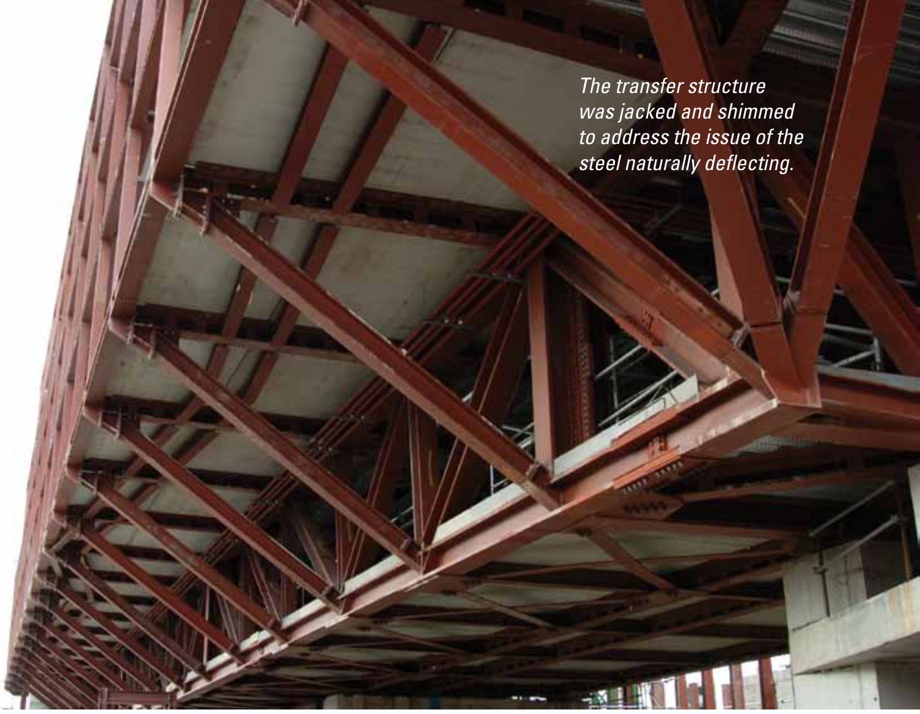
The construction of the second ISIS target station will keep the UK at the forefront of neutron research. The project will create a facility available to any organisation in the UK to examine the molecular structure inside any of its products. The results then show how good materials are at doing what they are designed to do, how they can be improved and what other properties they might have.

The station will enable scientists to make breakthroughs in materials research for projects relating to the next generation of super-fast computers, data storage, sensors, clean energy technology, and pharmaceutical and medical applications.

To create the neutrons for this research a proton beam is delivered to a target through a 143m-long tunnel. The 800 MeV beam from the ISIS synchrotron travels at 84% of the speed of light. The beam is housed, within the tunnel, in a stainless steel vacuum vessel surrounded by 35 quadruple magnets and eight bending magnets which keep it in alignment.

The beam is trained on a tungsten target which is 60mm wide and 300mm long and clad in tantalum to prevent corrosion. Each target has an approximate lifetime of five years.

Once the beam hits the target neutrons are scattered and delivered to a number of instrument tunnels, 18 in total, which surround the target's monolith structure. When the neutrons are collected within these instruments they are used for materials research.



The transfer structure was jacked and shimmed to address the issue of the steel naturally deflecting.

Complex design checks in at luxury hotel

FACT FILE
Grand Canal Quay Hotel, Dublin
Main client: *Heritage Properties*
Architect: *Manuel Aires Mateus & McCauley Daye O'Connell*
Structural engineer: *Arup*
Main contractor: *Pierse Construction*
Steelwork contractor: *Andrew Mannion Structural Engineers*
Steel tonnage: *1,800t*

A new steel framed hotel in Dublin, originally tendered as concrete, is rapidly taking shape in the city centre. Martin Cooper reports on one of the most innovatively complex steel designs ever produced in Ireland.

Dublin has for a number of years been a hive of construction activity, with one area in particular, the Docklands, seeing more than its fair share of new buildings. Situated to the east of the city centre, the former warehouses and industrial units along the River Liffey have been converted into office blocks and residential apartments.

In the middle of this area is the Grand Canal Square development which will have in its midst one of Ireland's most exciting and innovative steel structures.

Provisionally known as the Grand Canal Quay Hotel, this complex steel structure has already received a number of glowing reports in the local media. Once complete it is sure to be one of Dublin's most luxurious and prestigious hotels.

"The building was originally designed in concrete with a trapezoidal bridge structure for the transfer structure at first floor," explains Denis McNelis, Engineering Director of Andrew Mannion Structural Engineers (AMSE). "But due to a number of programme advantages afforded by steel, the decision was made to change to a steel frame."

AMSE together with Arup have since undertaken to deliver a highly complex alternative and one of the most innovative steel designs ever seen in Ireland.

"The design was complex for a concrete structure, even in its original form," adds Mr McNelis. "And steel has a number of benefits, not least the speed with which it can be erected."

The hotel features an eye-catching and dramatic column-free lobby which required a storey deep transfer structure consisting of primary and secondary trusses, supporting a six-storey beam and column frame. This open plan lobby area is only interrupted by the three main cores, which will house lifts and staircases.

The lobby will be one of the hotel's main architectural features, says Ray O'Connor, Senior Project Engineer for Arup. "The ultimate design is supposed to give the impression that one is looking through a large hewn opening in solid rock.

The lobby interior will eventually be clad around the cores to resemble rock and a clear view from street level will be afforded straight through the structure.

"The ultimate design is supposed to give the impression that one is looking through a large hewn opening in solid rock."

The supporting transfer structure consequently sits between ground floor and mezzanine levels, and will be used as an office and hotel staff accommodation area.

The transfer structure consists of four primary trusses or girders, each measuring 11m long x 3.5m high and each weighing 40t. The loads from the building are transferred to the primary trusses through 12

Below: Steelwork had to incorporate a chequer-board pattern requiring alternate off-set columns.

Above: The hotel is set in the middle of Dublin's fast-changing docklands area.

secondary trusses that run along the length of the building at the same plain. Further complicating the design a cantilever, of 4.5m out from the secondary trusses, extends around two sides of the structure.

At AMSE's fabrication yard full penetration butt welds were required at every joint on the transfer structure, with 3.5m long bolted splices to connect the secondary trusses to the primary trusses. "The welding alone took three months," says Andrew Mannion, AMSE Managing Director.

The most heavily loaded connection between the 65m multi-span secondary truss to the primary truss is transferring a huge 3,000t through 100 bolt connections.

As there are huge loads being transferred between the trusses, and a large number of bolt holes that had to be aligned, the tolerances available for erection were extremely tight. The corners of the structure are cantilevered through multiple trusses in two directions, with the load path from the corner column to the support point on the concrete wall being more than 15m in length.

Another complex issue which had to be overcome was the fact that the corners of the cantilever are actually trying to twist the building. To stop the twist more than 100t of bracing was used to tie back the cantilever corners.

"Using one 500t capacity mobile crane, positioning each section of the transfer structure required some precision lifting and exact setting out, with little or no room for error," says Mr McNelis. "Careful planning in terms of connection design, detailing and fabrication allowed the structure to be lifted into position smoothly."

Providing the required stability, the transfer structure is also held in position by a number of rock anchors buried 2.5m deep into the concrete walls with 100mm thick base plates.

Every connection on the transfer structure was individually designed. "There isn't any repetition, they are all unique," adds Mr McNelis.

Once the transfer structure was erected AMSE's phased steelwork programme started on the upper storeys of the hotel. This part of the project was equally challenging as the steel frame had to incorporate an architectural chequerboard pattern.

This pattern is actually part of the frame as Mr McNelis explains: "Rather than just a style gesture, it requires the steel columns to be offset relative to the floor below at alternate levels to accommodate the position of the building's glazed panels, and so achieving a thin continuous vertical joint. Basically the cladding dictates this part of the project."

AMSE has installed 203 x 203 columns all the way up, with each member offset by 350mm, centre line to centre line. As well as the offset columns, all beams are slightly skewed in plan and consequently so are the rooms.

Alternate floors have the columns in the same location, and mirroring this, each level of rooms has a configuration swap-over. This mainly involves the location of bathrooms, which have been installed as complete 5t pods, which had to be taken into account when designing the overall structural loading.

The most heavily loaded connection between the 65m multi-span secondary truss to the primary truss is transferring a huge 3,000t through 100 bolt connections

The hotel, which has a footprint of 85m x 21m, isn't the entire project, as attached to the rear of the structure is a seven-storey residential block. Although this structure is essentially concrete framed with architectural steel perimeter columns, it does have a large steel presence at its heart.

The ground floor of this tied-in adjacent block is taken up by the hotel's banquet hall. To allow for a large column free area, AMSE has erected fifteen 13m-long 914mm beams across the hall to support the ceiling.

Summing up a unique steel project Mr Mannion, says: "In terms of design this project is the most complex and challenging project we have ever undertaken. The job also presented significant fabrication, erection and design challenges, to match the architectural vision."

Below: The hotel's lobby will be below the transfer structure.

Project gains from multi material approach

A new extension to a shopping centre in Windsor has made use of a hot rolled steel frame alongside another light steel four-storey hotel structure, all built on top of a concrete podium.

Above: The hotel is constructed from a single skin light steel frame.

The King Edward Court shopping centre occupies a prestigious town centre site next to Royal Windsor railway station. The work has consisted of reconstructing a large portion of an existing mall to include an area once occupied by a number of individual retail outlets and an office block.

The new build consists of eight levels with a 113-bed Travelodge Hotel on levels three to eight. Bottom up, the rest of the development is: Level 1, warehousing and services for the shops above and access to a service road; Level 2, car parking connected into an adjacent retained multi-storey car park; Level 3, lower ground retail; Level 4, main mall trading level; Level 6, Waitrose anchor store trading floor; Level 7, plant and management storage facilities.

Level 5 and 8 only exist on the hotel portion of the project, due to the differing floor heights.

Two of the challenging aspects of the project were tying-in the new build structure to the retained existing concrete shopping mall, as well as keeping the service road - which runs right through the project at the lowest level - open to traffic throughout the construction programme.

"There are some complex interfaces at different levels to the existing car park and the retained mall," comments Gavin Walker, Project Manager for Peter Brett Associates. "And these areas had to remain open throughout the construction programme.

"As well as these issues, the tenants pretty much dictated the form of the retail zone and so we've ended up with a hybrid form of structure. In-situ and pre-stressed concrete lower down with hot rolled steel and light steel for the upper levels, all forming one monolithic structure."

The podium at street level was constructed in concrete, and this includes Levels 1 to 3. The retail Level 3 shopping area is accessed only via escalators from the Level 4.

The decision was taken to use concrete as it was deemed easier to marry this into the existing shopping centre, while achieving the clear storey heights. However, from the Level 4 slab upwards, the tenant's requirements for long spans meant hot rolled steel was used for the two upper retail levels.

"Basically all the levels - main retail mall, hotel entrance station entrance and car park access - come together at Level 4," explains Mr Walker. "The concrete slab for this floor ties-in with the upper floor of the existing shopping centre and a retained mall which gives access to the railway station."

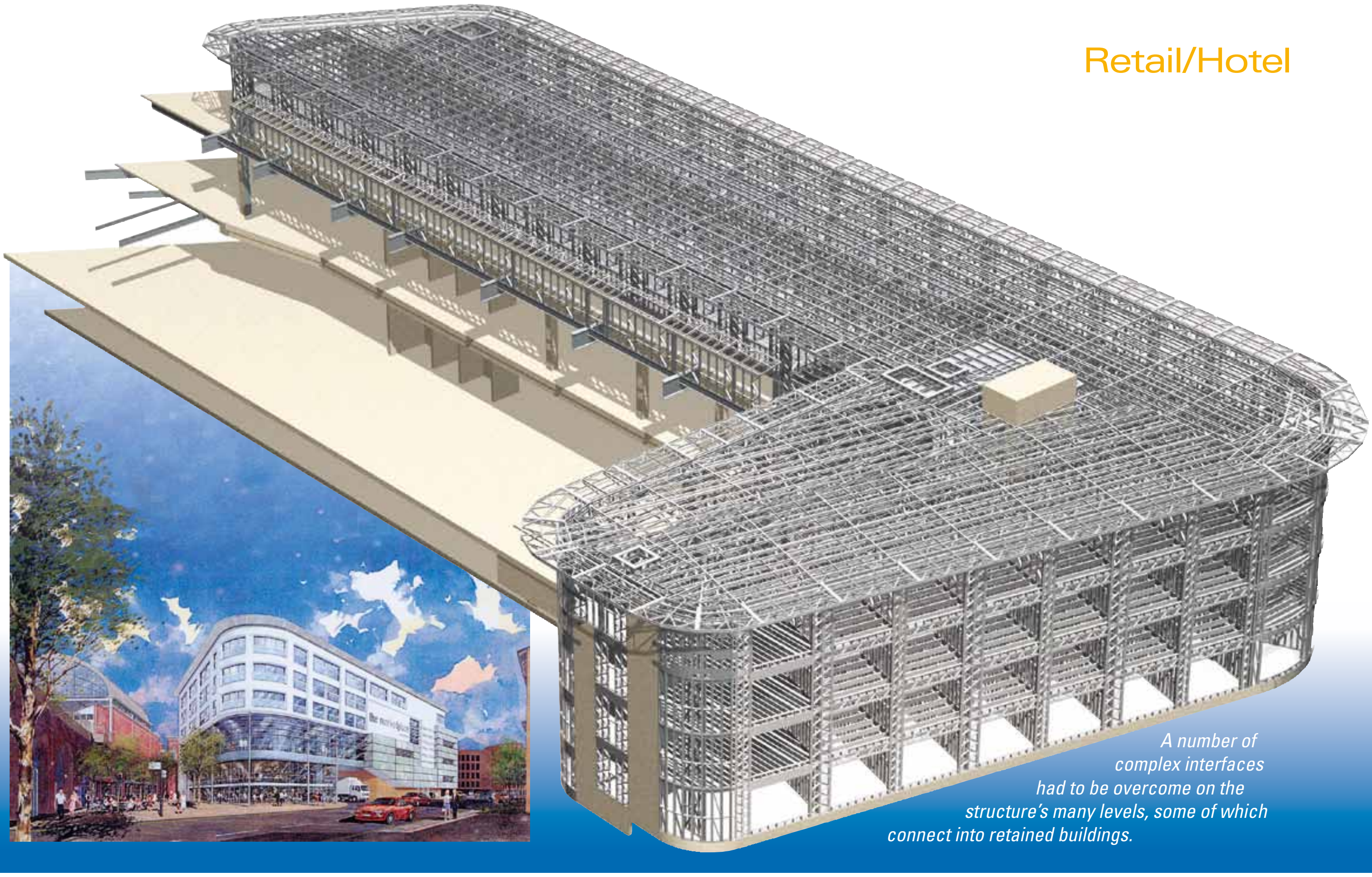
Approximately two thirds of the two upper levels of the retail zone were constructed with hot rolled steel members springing off the concrete slab and a pre-stressed concrete transfer bridge built over the service road.

Incidentally, the back third of the entire structure is all concrete up to the top level, as this section of the building surrounds the project's four stability-giving main cores.

Steelwork contractor Allslade erected the moment resisting two-storey high steel frame. In total the company erected approximately 260t of steelwork for this part of the project, using predominantly 305 columns and 686 x 254 x 152 perimeter beams.

"There was a requirement for minimal bracing because of the structure's glazed cladding, which

FACT FILE
King Edward Court, Windsor
Main client: Analytical Properties
Project managers: CB Richard Ellis
Architect: ESA
Structural engineer: Peter Brett Associates
Main contractor: Sisk
Hot rolled steelwork contractor: Allslade
Light steel framing contractor: Metek UK
Steel tonnage: 410t



A number of complex interfaces had to be overcome on the structure's many levels, some of which connect into retained buildings.

Above: the new mall and hotel occupy a prestigious Windsor town centre site.

Above: Long span cellular beams form the retail roof.

"It's unusual to build a monolithic structure with four main materials..."

wraps around one side of the building, so the frame had to be moment resistant," explains Peter Stocks, Allslade's Project Designer.

To incorporate this a bay deep truss, made up from CHS sections, ties the glazed frontage all the way back to the concrete cores.

Forming the roof of the new retail extension Allslade erected a total of 40 cellular beams which were 21m-long x 900mm-deep.

The cellular beams were so long that Sisk had to leave a sizeable gap in the podium's slab to allow the members to be lifted into the shopping centre. "Lifting the beams over the project from outside the site wasn't an option because of the site's location," says Mr Stocks.

"As well as offering lighter loads on top of the concrete podium, steel was also used because of the need for long spans within the retail zones and the speed of construction," adds Mr Walker.

Another integral element of the overall structure is located on the street-side of the project. This is the new Travelodge hotel which has been constructed primarily with light steel framing. The hotel, which also sits on top of the podium, but also has one floor within the concrete structure, comprises cross-walls generally at 3.8m spacing, and in some locations, up to 5.9m spacing.

The load-bearing light steel framing was manufactured and installed by Metek UK in just four months, while the contract was extended to include the infill walls to the concrete structure of the lower levels.

The light steel framing consists of single skin walls using 100mm x 1.6mm thick C-sections placed in pairs at 400mm centres for the lower floors reducing to single C-sections for the upper levels.

The hotel structure was braced by screw-fixed X-bracing on the cross-walls or by integral K-bracing on the facades.

The 250mm deep lattice floor joists are designed to span 3.8m between cross-walls when placed at 600mm centres, increasing to 5.9m when using heavier joists placed at 300mm centres. These joists support a 65mm screed placed on 16mm deep profiled decking.

This project is also one of the first to use a new flooring system from Metek and Lafarge which consists of a gypsum screed on steel decking attached to lattice joists.

The composite design of the gypsum screed acting with the joists greatly increases the stiffness of the floor and its acoustic insulation, while adding modestly to the mass of the floor.

Known as Metekfloor, the system consists of a light steel floor construction coupled with a fast-drying screed. On this project it helped the rapid completion of the three floors in just four months. Tests at the University of Surrey have shown that the composite action of the screed and light steel lattice joists increases the stiffness by over 100% and dramatically reduces vibrations and sound transfer through the floor.

The roof of the hotel structure was also designed as large braced panels in light steel framing and a 1.5m cantilever prow was added for visual effect. This was achieved by tapered lattice members attached to the cross-walls. The purlins for the roof are 100mm x 1.6mm C sections and span between cross-walls.

The top level of the hotel is larger than all preceding floors and extends by wrapping around and over the retail area.

"It's unusual to build a monolithic structure with four main materials," sums up Mr Walker. "But the retained structures and tenant requirements dictated the overall form."

Steel is designed for minimum waste

Minimising and where possible eliminating waste from construction operations is a key part of the UK's sustainability drive. Nick Barrett details why designing and building in steel is the best way to ensure waste minimisation.

There is an estimated 90M tonnes of construction and demolition waste generated in the UK each year. In the past much was sent to landfill but this is now recognised as a non sustainable solution.

The challenge for designers today is to minimise waste through all the stages of a buildings' life from design, through construction to refurbishment/adaptation to eventual demolition and site redevolpment. Designing in steel is one way in which architects and engineers already ensure that waste is minimised.

Waste is not only unwanted or discarded materials. Efficient designs minimise resource use and promote a "get it right first time" culture that eliminates a lot of the potential for waste. Efficient design has other benefits, such as producing buildings that are economical to maintain at appropriate temperatures for their users.

Perhaps the most important waste minimisation benefits from using constructional steelwork derive from the fact that production is predominantly an offsite process, which fosters creation of high quality structures, with low defects and a correspondingly little waste.

The challenge for designers today is to minimise waste through all the stages of a building's design

There are few waste products from steel production. For example, blast furnace slag is now used as a valuable secondary raw material in the cement industry and is no longer classified as a waste

Pile extraction

Careful selection of material for piling is proving to be a crucially important design decision as concrete piles are creating a legacy problem in areas such as central London, where they are proving to be extremely difficult to remove. Some sites are said to be becoming blighted as a result, wasting valuable and scarce development land.

Steel piles by contrast are easy to remove. Widely available technology now allows for quick and quiet extraction of redundant steel piles, allowing sites to be speedily redeveloped. Any steel recovered can be either reused or recycled.

In some cases the steel piles can be left in situ and used to support the next generation of building. Steel piles have been removed from the ground in near perfect condition after 100 years.

The ease with which redundant steel piles can be dealt with is found on a recent development site in Chelsea, where the Grosvenor Waterside development consists of a number of apartment blocks situated around two historic docks adjacent to Chelsea Bridge.

A number of old steel piles were discovered dating back to the early 1900s, the steel piles where originally installed to support a retaining wall around one of the docks. Now these 4m-long piles were in the way and a number of them had to be extracted.

Dawson Construction Plant (DCP) used specialist plant designed for quick and quiet steel pile extraction, which was important as the site is in the middle of a dense residential area.

DCP removed 24 piles in total, in four separate areas, over a week. Because the piles were submerged in extremely wet ground they were relatively easy to remove. The water also prevented corrosion, and once the first pile was pulled from the ground its pristine condition became apparent.

"This job perfectly demonstrates the durability of steel as even after nearly 100-years of service life it doesn't necessarily corrode," David Rowbottom, Corus Technical Sales & Marketing Manager says. "The piles were so well preserved we could even make out the rolling marks and the name Frodingham, which was the mill in Scunthorpe which produced them," he says.

Living Solutions

Modular construction provides energy efficient buildings thereby reducing CO_2 emissions over the life of a building. The efficiency of factory production reduces the amount of waste produced and modular construction generally requires less material than traditional construction methods.

Corus' Living Solutions business unit provides an opportunity to highlight how building with steel minimises waste. Corus has developed products which are lighter, stronger, and perhaps more importantly, consume less energy when they are used.

Corus Living Solutions takes a strong stance on sustainability by minimising waste through use of precision materials in the factory and a structured approach to the recycling of any waste materials generated.

The average number of deliveries to the building site has been reduced by up to 75% compared to traditional construction techniques. Living Solutions tracks and provides full traceability of all modules using a unique identification number. This will identify all materials used and can form part of any life cycle assessment for buildings.

Living Solutions has designed energy efficient buildings reducing CO_2 emissions over their lives. At the end of its life, a building can be demounted with the potential for reuse elsewhere.

Living Solutions produced the first modular buildings in the UK to achieve a BREEAM rating of excellence. A demonstrator project at Perham Down, completed in 2005, included a rainwater harvesting system, solar heating panels, low carbon index and low energy consumption levels.

Energy efficiency

Corus has made great strides in recent years towards energy efficiency of its production processes and the energy needed to produce steel is now about 40% less than in the 1970s.

Steel has a positive value at the end of its working life and its scrap value is used to offset other development costs

Waste during the manufacture of steel components is typically below 3%, and even this does not go to landfill as it is all recycled. On construction sites there is virtually no waste at all from steel and since 1992 Corus has reduced waste going to UK landfill by 62%.

Steel has a positive value at the end of its working life and its scrap value is used to offset development costs. Other materials are only suitable for downcycling (low grade recycling which does not generate products with the same properties as the original) and impose a demolition cost on the developers.

There is no hazardous wash out water and shuttering waste generated with steel; concrete for example generates an estimated 67% by weight of all construction and demolition waste.

Left: Efficient design minimises resource use, such as at the Broadgate and Bishopsgate development in the City of London.

Energy efficient warehouse

FACT FILE
ProLogis Park, Pineham, Northamptonshire
Main client: *ProLogis*
Architect: *RPS Burks Green*
Structural engineer: *Capita Symonds*
Main contractor: *Buckingham Group*
Steelwork contractor: *Atlas Ward Structures*
Steel tonnage: *2,190t*

Above: The ProLogis Park at Pineham has direct access to the M1 Motorway.

Steelwork has recently been completed on what is described as the most environmentally-friendly distribution centre in Europe.

Atlas Ward Structures has completed the steelwork for the flagship warehouse at the ProLogis Park in Pineham, Northamptonshire. The structure, which will use a number of advanced features designed to reduce energy consumption and carbon emissions, is said to be one of the most environmentally-friendly warehouses ever built.

The installed energy saving features include wall-mounted photovoltaic panels that generate electricity, a solar wall product that produces energy from daylight, a power plant that re-uses the heat produced by air-conditioning and an on-site recycling facility.

Also included are energy efficient lights and a system which will harvest rainwater for internal processes as well as distributing it to an adjacent ecological corridor for native plants and animals. The energy savings, combined with ProLogis' investment in an accredited carbon credit system, will mean the distribution centre will operate with a negative carbon footprint.

Ken Hall, Managing Director of Global Construction for ProLogis in Europe, says: "When completed, the building will be amongst the most environmentally advanced distribution facilities in the World."

The building has been pre-let to major supermarket chain Sainsbury's and forms a major element of a scheme which will eventually provide more than 1,500 jobs.

"We're pleased to be partnering with Sainsbury's on this development which will deliver significant efficiencies and long lasting environmental benefits," adds Mr Hall.

The state-of-the-art building has a footprint in excess of 57,000m² and required Atlas Ward to design, fabricate and erect 2,190t of structural steelwork.

With so many high-tech features to be installed, it was imperative to get the building's frame up and ready as quick as possible.

The structure is a portal frame, four spans wide and 44 x 8m-wide bays long. Bill Armstrong, Project Manager for Atlas Ward, says the building was fairly straightforward to put up with erection going quickly and smoothly in an alloted eight week programme.

The distribution centre has two attached office blocks along one facade, one with three storeys and the other a single floor structure. "We installed external feature columns for the larger office building," comments Mr Armstrong. "Along with brise soleil support steelwork."

Other steelwork included Atlas Ward erecting two attached plant rooms (pods) and a stand-alone Rescue and Recovery building. The latter is a single-storey portal frame building which needed approximately 200t of steelwork.

Commenting on the need for a quick steelwork turn-around, Rob Miller, Buckingham Contracts Director, says: "It has been a particularly tight programme and Atlas Ward were able to commence erection eight weeks after the award of the contract and complete some eight weeks later. This was vital to enable the follow on trades to progress."

Nigel Pickard, Atlas Ward Managing Director summed up: "We are delighted to have been involved with Buckingham, ProLogis and Sainsbury's on this flagship project. The Severfield-Rowen Group places the sustainability and carbon reduction issue high on the PLC agenda for 2007 and in the future."

Right: The warehouse has been pre-let to supermarket chain Sainsbury's.

The residential section of the project marries into the commercial zone but has slightly lower floor heights.

FACT FILE
70 Chancery Lane, London
Main client: *Ebble Developments*
Architect: *Sidell Gibson*
Structural engineer: *Ramboll Whitbybird*
Main contractor: *Skanska*
Steelwork contractor: *Bourne Steel*
Project value: *£23M*
Steel tonnage: *700t*

Mixed use development retains historic façade

A new steel framed commercial and residential project in a London conservation area required some intricate designing, around a retained façade, to allow it to complement its surroundings.

The number of inner city projects requiring contractors to retain old facades, while constructing a new and often larger premises inside is gathering pace. Conservation areas have proliferated in recent times and councils and city authorities are loathe to tear down old buildings without giving some thought to what could be preserved.

Central London has seen more than its fair share of these projects and one of the latest examples is the new £23M mixed use development that sits on a site bounded on two sides by Chancery Lane and High Holborn.

Prior to construction a number of structures of varying ages needed to be demolished, leaving a retained 19th Century facade along most of the High Holborn and Chancery Lane frontages.

"The façade was load bearing masonry, but the retained feature will only support its own weight."

The new steel-framed building stands on a raft foundation with three concrete cores providing stability. Main contractor Skanska, says close attention has been paid to the Chancery Lane conservation area, in which the development resides, and the building will provide a traditional exterior, complementing its surroundings.

"The facade was load-bearing masonry, but the retained feature will only support its own weight," explains Mike Roberts, Project Engineer for Ramboll Whitbybird. "Retaining this facade meant one of the project's main drivers was then the resultant fixed floor levels."

To achieve the same floor levels within a tight structural zone, beams with a maximum 500mm depth were used to marry into the original facade. Initially steelwork began at basement level with Bourne Steel installing 35 columns to support the ground floor concrete slab. These supporting columns varied in size, but the largest 356mm x 406mm members weighed in at 8t each.

"We came on site around Easter time and installed these lower columns," says Ryan Long, Project Manager for Bourne Steel. "Then once the ground slab was poured we came back and erected the majority of the steel frame between April and August.

Above: Large open column free spans were a requirement for the commercial part of the building.

"We then split the project into phases and progressed quickly upwards," adds Mr Long. "As with all inner city projects space and access was challenging, and logistically we had to work around other trades."

One on-site tower crane was shared by all trades and steel erection was also aided by two cherrypickers working off of the ground floor slab.

Bourne's phased steelwork erection saw it build the main commercial block up to the third floor splice, before turning attention to the residential area.

At first floor level Bourne had to erect two large 780mm deep transfer beams over a lightwell and loading bay area. "Columns would have come down right in the middle of this area, so these transfer members were, as well as being some of the heaviest pieces installed, vitally important." adds Mr Roberts.

The building consists of six levels, including the ground floor, with approximately 1,000m² per floor. The basement will be used for retail storage, the ground floor will accommodate entrances and retail outlets, while all other levels will be office and residential apartments.

"The residential section of the project is nearly an independent frame," explains Mr Long. "It shares some columns and a core, but it has lower floor heights as historically this part of the building has always been residential."

"Planning constraints dictated that we designed the building to look like a collection of individual buildings"

"Again it was important to marry into the original floor heights and retained facade windows," adds Mr Roberts.

Located to the rear and along the Chancery Lane frontage it will house two apartments per floor and features spans of no more than 5m widths, with columns and beams being mostly 254 x 254 sections. "It's all fairly light stuff for this frame," comments Mr Long.

The lighter residential frame was erected with light rolled steel beams and columns, and metal decking with an imposed load of 1.5kN/m², as opposed to 3.5 +1kN/m² in the commercial part of the structure.

Because the site is very restricted, Bourne continued its phased erection process once the residential block had reached the third level. It then erected the commercial zone up to the top level working its way across the structure by finally erecting the upper three floors of the residential zone. Incidentally, the commercial zone has a grid pattern which incorporates 13m spans at 6m centres.

"Planning constraints dictated that we designed the building to look like a collection of individual buildings," says Mr Roberts. "The amount of step in at fourth and fifth floor varies around the perimeter to help achieve this."

Marrying the new steelwork to the retained facade also posed one of the biggest challenges of the project.

Mr Roberts, says: "We recommended an in-situ concrete strip around the floor perimeter which was a practical solution developed to help on site coordination between the old and new structure.

"Consequently the metal decking stopped 750mm short of the facade and the concrete perimeter strip connected to the retained masonry via steel brackets."

Mr Long adds: "To replicate the retained facade's appearance we are installing some lightweight steelwork which will form the mansard as well as chimneys."

Along the top of the retained facade the original brick chimneys have been demolished, and so new steel framed modules have been erected, which will be clad to resemble the original features. Again, these new chimney features will aid the impression that the structure is a collection of individual buildings.

Summing up the successful steelwork job Mr Long, says: "The weather didn't help, but we've negotiated a particularly bad summer and a short steel erection programme to complete the work on schedule."

One half of the Holborn frontage incorporates a retained façade.

Building Design Using Modules

Modular Construction using off-site prefabricated units is increasingly being used on live projects. SCI's Mark Lawson examines the benefits.

Introduction

The use of modular construction is increasing as the benefits of off-site prefabrication and improved quality in manufacture are realised for residential buildings, for mixed commercial/housing projects, educational and health sector buildings. Many innovative forms of modular construction now involve the mixed use of steel frames and modular units, as illustrated in Figure 1.

Figure 1 – Unite Project in Plymouth; Modules supported by inclined tubular columns.

A new SCI publication 'building Design using Modules' reviews the basic principles of design using modular construction and addresses the opportunities to achieve a sensible level of standardisation, covering basic dimensions for planning interfaces with cladding, services and other details.

The following types of modules may be used in the design of buildings either using fully modular construction or mixed forms of steel construction:

Four sided modules

Figure 2 – Module being lifted in the factory (courtesy Corus Living Solutions).

Modules may be designed to transfer loads continuously through their longitudinal walls by manufacture with four closed sides to create cellular type spaces, as shown in Figure 2. The maximum width of the module that is suitable for transportation and installation limits the cellular space that is provided. Their external width is up to 4.2 m (2.7 to 3.6 m are typical internal modular widths for most applications). The module length is typically 6 to 10 m.

The walls typically use 70 to 100 mm deep C sections. The maximum height of a modular building is limited by the compression resistance of these members and also the bracing in the walls. The floor joists are typically 150 or 200 mm deep, and the combined floor and ceiling depth is in the range of 300 to 450 mm. Additional steel angle members may be introduced in the recessed corners of the modules for lifting and for improved stability. Module to-module connections are usually in the form of plates that are bolted on site.

The modules are designed for the combined vertical load of the modules above and in-plane loads due to wind action. The maximum height of buildings in fully modular construction is typically 6 8 storeys, depending on location and exposure to wind loading...

Partially open-sided modules

Four sided modules can be designed with partially open sides by introduction of corner and intermediate posts and by using a stiff continuous edge beam in the floor cassette. The maximum width of opening is limited by the bending resistance and stiffness of the edge member in the cassette.

Two modules can be placed together to create wider spaces, as shown in Figure 3. The compression resistance of the corner or internal posts controls the maximum height of the building. Modules can also be re-orientated at the internal posts to permit design of more flexible building forms. Balconies or other components can be attached to the corner or internal posts. Overall stability is provided by additional bracing located in the walls of the modules. Temporary bracing for stability during lifting may be required in the open sides.

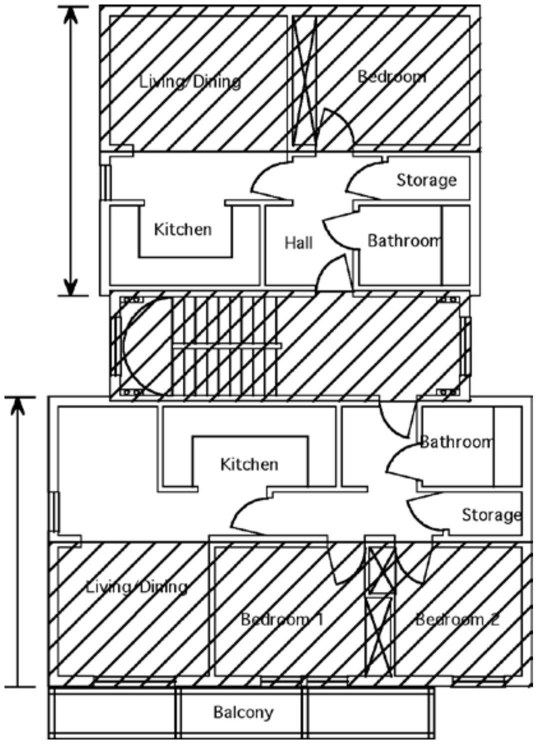


Figure 3 – Layout of apartments using partially open sided modules – alternate modules are shaded (courtesy PCKO Architects).

Corner-supported modules

Modules may be designed to provide fully open sides by transfer of loads to the corner posts, as illustrated in Figure 4. The framework of the module

Figure 4 – Primary steel frame used in an open sided module (courtesy Kingspan).

is often in the form of hot rolled steel members, such as Square Hollow Section (SHS) columns and often Parallel Flange Channel (PFC) edge beams, A shallower PFC section may be used to support the ceiling, but in all cases, the combined depth of the edge beams is greater than for 4 sided modules. However, modules can be placed side by side to create larger open plan spaces, as required in hospitals and schools etc.

The stability of the building generally relies on a separate bracing system in the form of X bracing in the separating walls. For this reason, fully open ended modules are not often used for buildings more than 3 storeys high. Where used, infill walls and partitions within the modules are non load bearing, except where walls connected to the columns provide in plane bracing. Lighter wall studs may be used than for load bearing 4 sided modules.

Mixed modules and floor cassettes

In this 'hybrid' or mixed form of construction, long modules may be stacked to form a load bearing serviced core. Floor cassettes span between the modules and load bearing walls, as illustrated in Figure 5. Floor cassettes may be attached to the walls of the module usually at the corner or intermediate posts. Because of the combined depth of the floor and ceiling of the module, it is advantageous to design the floor cassettes to be relatively deep.

Figure 5 – Hybrid modular and planar construction (courtesy Corus Living Solutions).

The form of construction of the modules is similar to that described for open sided modules, but the loading applied to the side of the modules is significantly higher. Therefore, this form of construction is limited to buildings of 4 6 storeys high.

Modules supported by a primary steel structure

Modular units may be designed to be supported by a primary structure at a podium or platform level, in which the supporting columns are positioned at a multiple of the width of the modules (normally 2 or 3 modules). The beams are designed to support the combined loads from the modules above (normally a maximum of 4 6 storeys).

The supporting structure is designed conventionally and provides open plan space at ground floor and below ground levels. This form of construction is very suitable for mixed retail, commercial and residential developments. Modules can be set back from the façade line. An example of a mixed development in Manchester is shown in Figure 6. The ground floor and below ground car parking is a conventional composite structure.

Alternatively, non load bearing modules can be supported by a primary frame, and are installed as the construction proceeds. Modules can be disassembled in the future to leave the floor cassette supported by the beams. An external steel structure, which consists of a façade structure that acts to stabilise the building may also be used. Modules are placed internally within the exo skeleton, as shown in Figure 7.

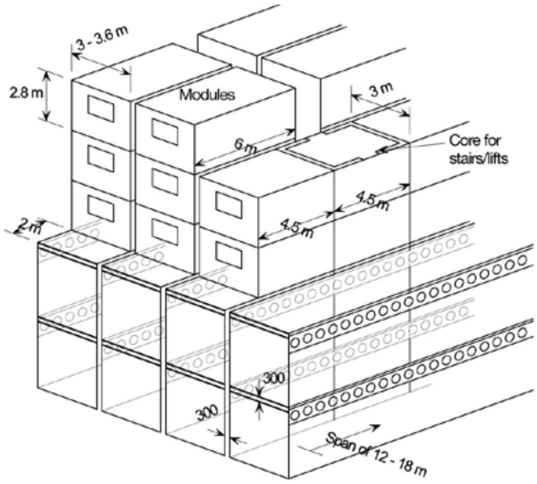


Figure 8 – Modules supported by long spanning cellular beams to create open plan space at the lower levels

A possible example of a podium using cellular beams is shown in Figure 8.The beams are designed to align with the ends of the modules i.e. at 3.6 m to 4 m spacing, which dictates the grid of columns (i.e. at 7.2 to 8 m). A grid of 7.2 m is very suitable for below ground car parking.

In the Paragon project in west London for Berkeley First, a concrete core was used to stabilise the 17 storey modular building, as illustrated in Figure 9. This is the tallest modular building in the World and demonstrates the capabilities of corner supported modules to provide flexible apartment layouts.

Figure 6 – Typical podium structure in which seven storeys of residential units are supported on a composite frame below (courtesy The Design Buro, Rollalong and Ayrshire Framing).

Figure 7 – Installation of modules behind external steel framework at MoHo, Manchester (courtesy Yorkon and Joule Consulting Engineers).

Figure 9 – Concrete core used to support 17 stories of modules, at Paragon, West London (courtesy Caledonian Building Systems).

Design made easier and faster

New Steel Construction rounds up some of the latest developments in structural steel design software packages.

Engineers benefit from the Fastrak approach

MP Consulting Engineers, formed by Partners Richard Murray and Stephen Parker in 2004, is a company with a dynamic approach to a wide range of projects in the steelwork sector.

The firm has always realised its need for state-of-the-art, time and cost saving design tools to enable it to compete and so an investment was made in CSC's Fastrak Building Designer.

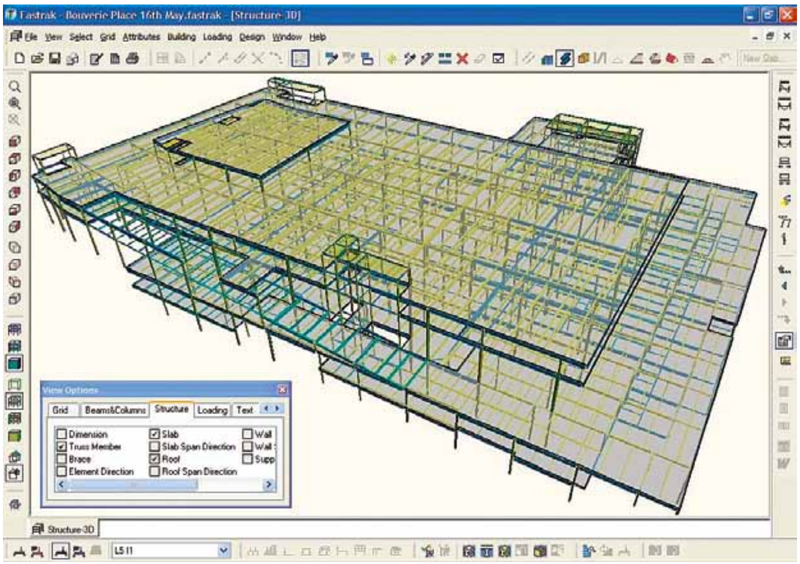
The investment has yielded rewards in many projects including the recent development at Bouverie Place in Folkestone, Kent. In partnership with steelwork contractor Robinson Construction the company provided a full design service for the steel frame.

The development is a highly complex layout comprising four levels of retail units topped with two further floors of car parking.

"The ability to issue design drawings automatically, generated by Fastrak, gave the fabricator fast and accurate design information on which to base fabrication details," says Mr Parker.

Robinson's in-house design team was also able to use the same design software to provide connection designs quickly and accurately.

"The ability to design large and complex schemes, such as Bouverie Place, has allowed us to work with a leading steelwork contractor and provide a quality result on time and budget," sums up Mr Parker.



For more information contact: Tel: 0133 239 3000 or visit www.cscworld.com

New StruCad release offers reduced detailing time

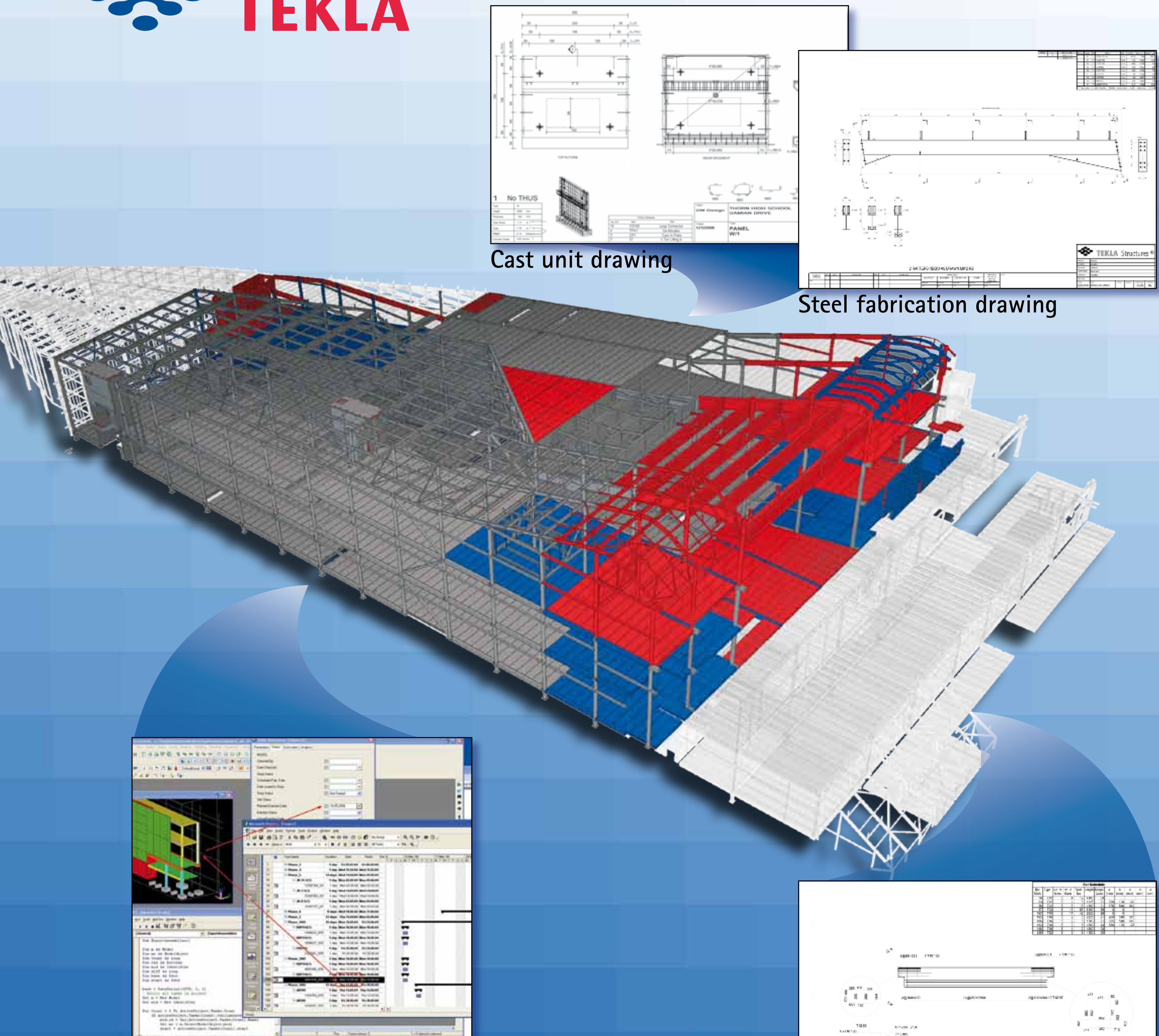
StruConnect is the very latest addition to the StruCad detailing system and is an integrated connection design tool, enabling users to design and modify connections as required. This new development allows bi-directional transfer between the design programme and the StruCad joints and will form part of the new content of StruCad V13, which is due to be launched later this year.

StruCad V13 will be yet another major release for AceCad Software this year and also includes a new macro connection wizard which is set to rapidly increase modelling speed. This feature automatically applies appropriate connections to an existing set of members, dramatically reducing detailing time. Other new tools incorporated include several CAD macros, that graphically create shapes and increase detailing flexibility, including enabling graphical editing of base drawing files. With improved shaping tools for cutting and editing members, this latest version of StruCad will deliver both enhanced interactive modelling facilities and increased manipulation.

Improved graphical representation in drawings, including enhanced connection detail and automatic labeling of General Arrangements, is combined with an increased range of outputs and latest system support for DWG/DWF and PDF.

For more information contact AceCad Software Tel: 01332 545800

TEKLA



Bar Schedule											
Bar Mark	Type	No. of Mbrs	No. in Each	Total No.	Length	Shape Code	a (mm)	b (mm)	c (mm)	d (mm)	e (mm)
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86	T12	3	6	18	1800	21	675	540	540		
97	T12	3	19	57	6100	99	0	0	0		
163	T10	3	14	42	2650	99	0	0	0		
185	T16	3	2	6	2225	21	900	510	510		
186	T16	3	2	6	1700	21	635	510	510		
193	T16	3	2	6	1800	13	880	125	125		
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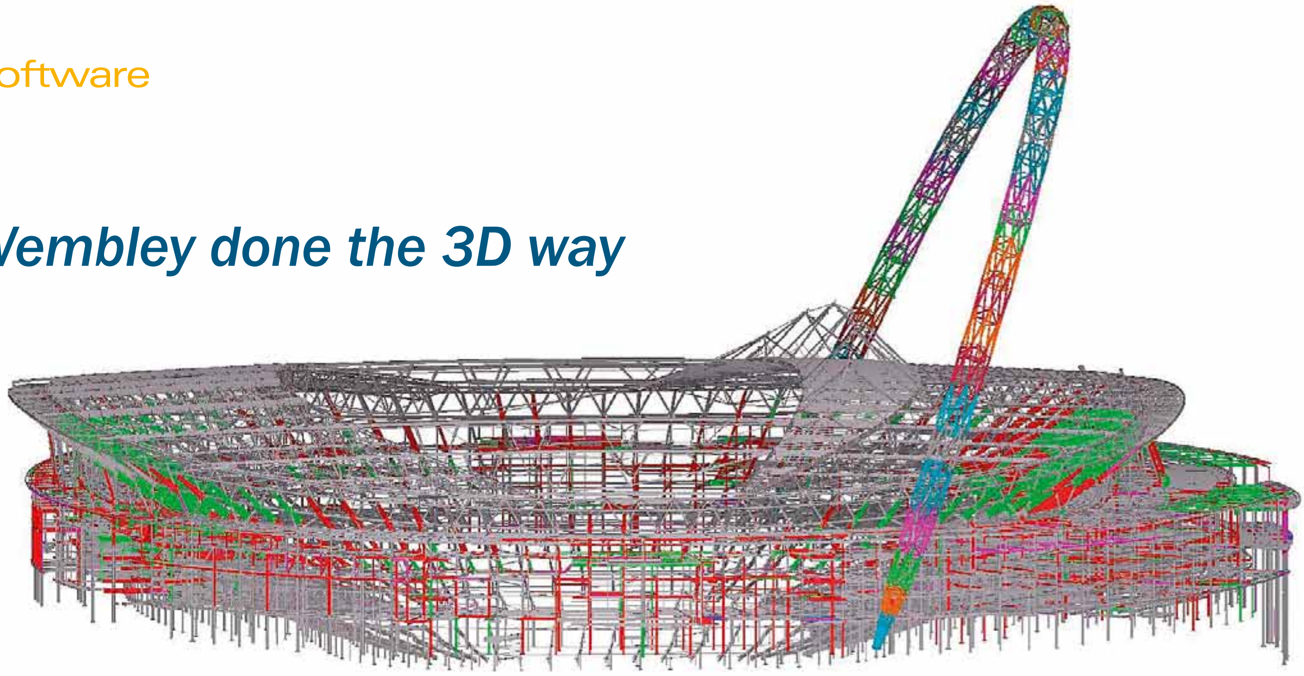
Wembley done the 3D way



The Tekla Corporation has recently launched its annual main version of Tekla Structures the Building Information Modelling (BIM) application. It is a 3D multi-material BIM software tool, that streamlines the construction design and delivery process from the planning stage to design and manufacturing.

A number of industry sectors have moved from a two dimensional (2D) format to intelligent 3D models to allow the resulting information to be presented on drawings and reports in a coordinated form. The 3D technology has developed into BIM solutions where all multi-material building objects can be defined in the model.

Many iconic projects have been completed, both in the UK and globally using the Tekla Structures application. The software can be used for planning and design development through to manufacture and construction. resulting in an as-built model of the building. One such project is the new Wembley Stadium.

The physical model for the approximate 23,000t project was split into four main categories: the arch; bowl; parametric perimeter truss and the roof, which was subsequently split into 160 phase models before being brought back again to a single model at the end of the project.

The main grid had nearly 2,500 intersection points accurately calculated to eight decimal places of a millimetre. The 3D coordinates of which where then distributed to other contractors for their setting out purposes.

For more information contact: Tel 0113 307 1200 or visit www.tekla.com/uk

CADS update Advance Steel package

Computer and Design Services (CADS) will launch the latest Advance Steel 8.1 package this month, a version which supports both 64 and 32-bit operation.

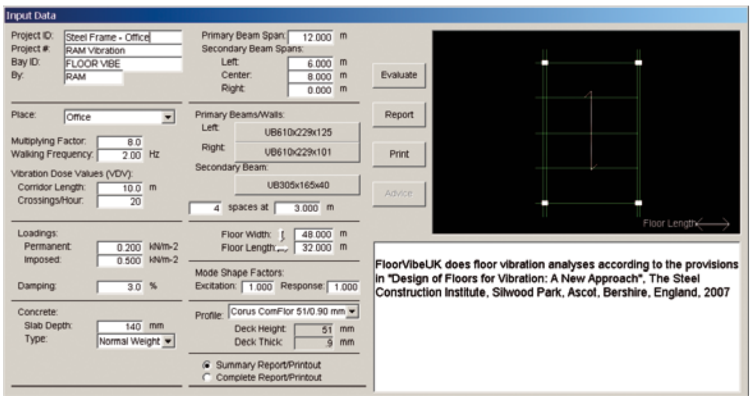
The package has added functionality for secondary steelwork, something Advance Steel excels at, including conical plates, twisted plates and bolted tread options.

There is improved automation for viewing drawings, a configuration tool and further improvements to the detailing of eaves and apex haunches.

The mezzanine improvements continue to make Advance Steel the ideal tool for specialist fabricators. There are new cold rolled trimmer cleat macros for single and double sided cleats, while base trimmer cleats have been added along with updates to the drawing styles.

For more information contact: Tel: 01202 603031 or visit www.advancesteel.co.uk

Bentley designs for floor vibrations



Steel Construction Institute (SCI) has recently withdrawn its publication P076 and replaced it with SCI publication P354. This new guidance document has been written to enable designers to determine the vibration response of sensitive floors with improved accuracy.

"It is now essential that all engineers who are working on steel buildings adopt this new guidance," says Andrew Miller, Project Manager at Bentley Systems.

"We have now enhanced our RAM Structural System (RSS) with the requirements of P354 - thus allowing designers using RSS to fully ensure that their project satisfies the new stringent criteria for floor vibration."

All RSS clients who are on the Bentley maintenance agreement - known as SELECT - will receive this new enhancement as a free upgrade.

For more information contact: andrew.miller@bentley.com

Building with Steel

Attractive new bridge at Windsor

Victoria bridge, which carries the Datchet-Windsor road over the River Thames, was one of a pair constructed about 1851 by the London and South Western Railway Company as part of the compensation for royal land made available for their railway work.

The original bridge was a five ribbed cast iron elliptical arch flanked by arched abutments. As a fixed arch it was subject to damage from even the slightest movement of the foundations. The arch ribs became cracked at the quarter points and, despite several repairs, a load limit of 3 tons became necessary after WWII. A military heavy girder bridge was constructed over the old bridge in 1963.

The new bridge was designed by Mott Hay & Anderson to accord with the special requirements of the site and be visually acceptable in the context of the original arched abutments. The new bridge allows a headroom of 20 ft 9 in for river traffic above normal water level, and the span between bearings is 123 ft 6 in. It follows the original design of an elliptical arch, providing the widest possible opening for vessels.

The two steel box arch ribs are will able to resist the bending stresses which result from adopting this shape. Bending due to fixity is eliminated, as the ribs rest on new pinned bearings at the abutments. Each arch rib is a welded box of high yield stress steel to BS 963, 3 ft 6 in wide by 2 ft 6 in deep. The corner welds connecting the $1\frac{1}{4}$ in flanges to the $\frac{5}{8}$ in web plates were made externally in V-preparations within the thickness of the flanges. There is a single site splice at mid-span. The deck is a 32 ft wide single reinforced concrete slab.

The ribs were preassembled and checked, and then transported to the site by barge. A 100-ton travelling crane standing on the abutments erected the half ribs, which were supported on a temporary mid-river trestle until spliced. The bearings were carefully jacked riverwards until the centre splice was closed, and then trued up to 0.010–0.012 in clearance. After a loading test, measured deflections were less that those calculated, probably owing to the stiffening effect of the deck acting compositely with the arch ribs for part of the span.

The bridge opened to traffic on 17 March 1967.

AD 315
Bending Strength – BS 5950-1: 2000

This AD covers the interesting effect when calculating the bending strength, p_b for Class 3 members, compared to Class 1 and Class 2. Compared to Class 1 and 2, Class 3 sections are understood to be more prone to buckling, and therefore "less capable", yet for the same slenderness, the calculated bending strength increases. This point has been raised many times with the Advisory Desk and this AD note explains the effect. The increase in p_b for Class 3 sections does not lead to an over estimate of the calculated buckling resistance moment, M_b, of the member, since a smaller modulus (compared to Class1 and Class 2) is used when calculating the buckling resistance.

Figure 1 shows typical moment rotation curves for the categories of section classification in BS 5950-1. The moment capacity (the cross sectional capacity), M_c, is calculated using the appropriate section modulus. To calculate the buckling resistance moment M_b, the previous version of BS 5950-1 (1990) contained a simple procedure that related the buckling resistance moment to the plastic modulus of the section alone irrespective of the section classification of the member. From time to time this resulted in the strange situation where the calculated buckling resistance moment, M_b, was greater than the moment capacity, M_c, of the member. This situation arose in Class 3 sections when M_b, based on the plastic modulus, was larger than M_c, calculated using the elastic modulus. Clearly the lower value should have been used in design.

BS 5950-1: 2000 Clause 4.3.6.4 updated the procedure for calculating the buckling resistance moment and identified that the modulus to be used in calculating both M_c and M_b should be the same, as defined by the section classification of the member. This varies from the full plastic modulus for Class 1 and 2 sections down to an effective section modulus for Class 4 sections. However many designers are surprised to find that as the value of the modulus to be used reduces in line with the section classification of the member, the bending strength, p_b, increases.

Figure 2 shows buckling curves for a Class 1 (or 2) section and a Class 3 section. The theoretical elastic critical moment curve M_{cr} for a particular bending scenario is also shown. It is important to note that this figure illustrates moment versus slenderness,λ, ($\lambda = L_E / r_y$) not equivalent slenderness, λ_{LT}.

In Figure 2, it is assumed for illustration purposes that when a Class 3 member is substituted for a Class 1 or Class 2, the only effect is the change of classification. In reality, most of the design parameters change (e.g. I_{xx}, Z_{xx}, r_y).

Lateral torsional buckling is a complex phenomena but the first important point to note in Figure 2 is that for the Class 1 (or 2) section the buckling resistance moment, M_b, has an upper bound material limit of M_p, the plastic moment capacity of the section. For the Class 3 section the buckling resistance moment, M_b, has an upper bound material limit of M_e, the elastic moment capacity of the section.

Figure 2 shows that for the same slenderness λ, the buckling resistance moment for a Class 3 section is a higher proportion of the elastic moment capacity M_e than the buckling resistance moment of the Class 1 section compared to its plastic moment capacity, M_p. For the Class 3 section $M_b = 0.9 M_e$ while for the Class 1 section $M_b = 0.8 M_p$. The bending strength, p_b, is higher ($0.9p_y$) for the Class 3 section than for the Class 1 Section ($0.8p_y$).

The design procedure in BS 5950-1: 2000 for lateral torsional buckling varies the bending strength p_b in order to reflect this effect in structural calculations. This is primarily achieved by the use of the β_w ratio from Clause 4.3.6.9, which for a Class 3 or 4 section is less than one. The square root of this ratio, used in the calculation of the equivalent slenderness, makes λ_{LT} for a Class 3 or 4 section less than that for a Class 1 section. This leads to a higher bending strength p_b from Table 16 or Table 17 in BS 5950-1: 2000.

The actual buckling resistance moment for the Class 1 section is greater than that for the Class 3 section (since the resistance moment is the product of the bending strength and the modulus), although the bending strength, p_b, will be higher for the Class 3 section.

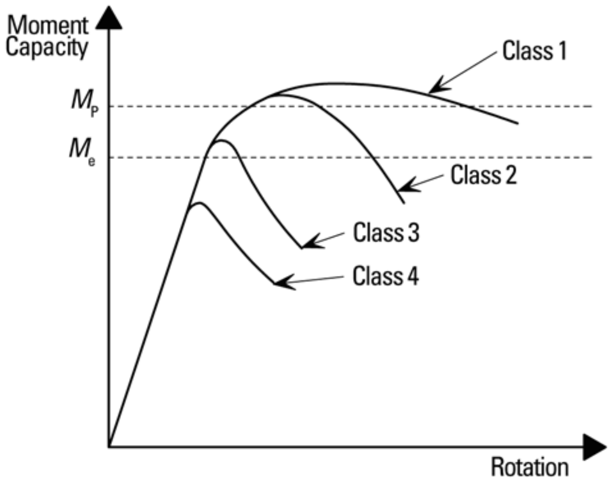


Figure 1 – Typical moment rotation curves

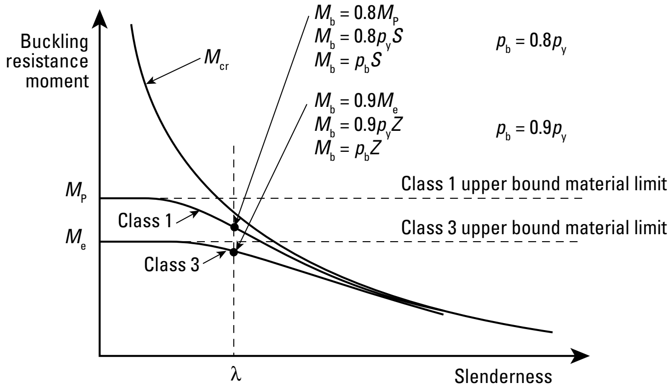


Figure 2 – Buckling resistance moment versus Slenderness

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Building design using modules

Catalogue Reference: P348
Author: R M Lawson

Essential design information for construction using modules

The use of modular and other lightweight forms of building construction is increasing. The benefits of off-site prefabrication and improved quality in manufacture are being realised for residential buildings, for mixed commercial/housing projects, educational and health sector buildings.

This publication reviews the basic principles of design using modular construction and addresses the opportunities to achieve a sensible level of standardisation, covering basic dimensions for planning interfaces with cladding, services and other details.

It addresses the following essential topics:

- Types of modules
  - 4-sided modules
  - Partially open sided modules
  - Corner supported modules
- Mixed modular and panel construction
- Modules and primary structure
- Other types of modules
- Technical issues
- Dimensional planning
- Sources of information.

For further details, please refer to the Technical Article, by the author, Dr R M Lawson on page 28 of this issue.

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New and Revised Codes & Standards

(from BSI Updates September 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 1993:-
Eurocode 3. Design of steel structures
BS EN 1993-1-7:2007
Plated structures subject to out of plane loading
No current standard is superseded
BS EN 1993-6:2007
Crane supporting structures
No current standard is superseded

UPDATED BRITISH STANDARDS

BS 5950:-
Structural use of steelwork in building
BS 5950-1:2000
Code of practice for design. Rolled and welded sections
AMENDMENT 1, *also incorporates CORRIGENDUM 1*

BRITISH STANDARDS DECLARED OBSOLESCENT

BS 4395:-
Specification for high strength friction grip bolts and associated nuts and washers for structural engineering
BS 4395-1:1969
General grade
BS 4395-2:1969
Higher grade bolts and nuts and general grade washers

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT

07/30107797 DC
BS EN 14399-9 High strength structural bolting assemblies for preloading. Part 9. System HR or HV. Bolt and nut assemblies with direct tension indicators

07/30133498 DC
BS 7882 Method for calibration and classification of torque measuring devices

07/30166055 DC
BS EN 14399-10 High-strength structural bolting assemblies for preloading. Part 10. System HRC. Bolt and nut assemblies with calibrated preload

The British Constructional Steelwork Association Ltd

You can find email and website addresses for all these companies at www.steelconstruction.org

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 Tel: 020 7839 8566 Email: gillian.mitchell@steelconstruction.org

KEY

Categories
- **A** All forms of building steelwork
- **B*** Bridgework
- **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

Quality Assurance Certification
- **Q1** Steel Construction Certification Scheme Ltd
- **Q2** BSI
- **Q3** Lloyd's
- **Q4** Other

Classification Contract Value
- **10** Up to £40,000
- **9** Up to £100,000
- **8** Up to £200,000
- **7** Up to £400,000
- **6** Up to £800,000
- **5** Up to £1,400,000
- **4** Up to £2,000,000
- **3** Up to £3,000,000
- **2** Up to £4,000,000
- **1** Up to £6,000,000
- **0** Above £6,000,000

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