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NSC

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SUNDERLAND ROYAL HOSPITAL
Client: City Hospitals Sunderland NHS Foundation Trust
Steelwork Contractor: South Durham Structures Ltd
Design & Build Contractor: Kier Northern Ltd
Structural Engineer: Arup

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Steel success message spreads

Nick Barrett - Editor

The message about the remarkable success of the steel industry in capturing market share in the multi-storey sectors over the past 20 years has clearly spread far and wide. A delegation of visitors from other European steel sectors visited the UK last month under the auspices of the European Convention for Constructional Steelwork to hear from the horse's mouth how it was done (see News).

The bare market share figures are striking enough – over 70% of the high rise office market and 43.5% of multi-storey residential – but they are even more laudable when compared to the situation 20 years ago. Then, the industry only wanted to provide columns and beams when customers wanted a solution including floors, which the concrete rivals provided. Steel could not be delivered to site in the time frame customers wanted, whereas concrete, however unknown the quality, could start flowing straight away. Fire and corrosion protection had to be added, awkward to do on site, while concrete was seen as having these features built in. Safety was another issue, with steelwork erection perceived to be inherently dangerous. It is hardly surprising that steel was not even considered for many projects.

What a contrast with today. As the previously assumed benefits of concrete are exposed as not matching reality as closely as thought, an integrated steel supply chain delivers what is wanted to customers who have been convinced by their own experiences of the outstanding advantages of building in steel. All strands of the supply chain from producers to designers and steel contractors have come together to ensure that customer focussed, seamless solutions are available, with full technical support. The steelwork industry has an improving safety record and an increasing amount of fire protection is applied in offsite factory conditions.

The lesson for the continentals is that first of all they have to get all parties involved in the successful delivery of a steel structure reading from the same prayer book, and present united fronts to their respective markets. There is no reason why they cannot enjoy more success by adopting the same strategies which have served the UK steel industry, and its customers, so well.

Rig threat averted

One of the leading steel figures during those 20 years of transformation in the industry's fortunes was Professor Patrick Dowling, who is profiled in this issue. One of the stories which is not told in the profile, for reasons of space, is how he combated a severe threat to the future use of steel in the key North Sea market. A major problem had arisen with the welding at the Conoco tension leg platform which was being fabricated at Nigg Bay, near Inverness. Work had come to a halt, the workforce was on strike and there was a possibility that the platform would be abandoned, which would have been a disaster for rig fabrication throughout the UK.

Prof Dowling was appointed to head a trouble shooting team to solve the problem, which turned out to not be fundamentally about welding at all. The main problem he found was that nobody was talking to anyone; there had been a complete breakdown in trust and communications between entrenched parties. Establishing the proper channels of communication was the first step to allow everyone to start pulling in the same direction. Everything else fell into place after that, the welding issues were soon sorted and the platform successfully delivered. "We were helped by the whisky," says Prof Dowling. Maybe we should give some to our European friends to take home.

Industry to gain responsibility for Eurocode annexes

The British Construction Steelwork Association, Corus and the Steel Construction Institute have been given a strong indication from the government that a contract will be let to them to develop the National Annexes to the steel and composite Eurocodes. The expected decision, by the Office of the Deputy Prime Minister and BSI, has been welcomed by the industry.

BCSA Director of Engineering Dr David Moore said "We are delighted that the Government recognises the importance of the Eurocodes and that it is giving some priority to supporting the implementation of the Eurocodes in collaboration with the steel industry."

The National Annexes set out Nationally Determined Parameters (NDPs) — aspects of the codes which are not harmonised across Europe. They include factors of safety and other parameters such as the scope of alternative design methods.

The contract is expected to apply to parts 1.1 and 1.2 of EC3 (steel structures) and EC4 (composite steel and concrete structures) covering general rules, rules for buildings, and fire design, and in addition EC3 part 1.8 covering joint design, and part 1.10 on material toughness and through thickness properties.

SCI senior manager for standards Charles King said once the award was confirmed there would be a calibration process in which the results of designs to BS5950 would be compared with the equivalent design to the Eurocodes. "Where differences occur they will be examined to decide why they occur. Where they occur because the Eurocodes are founded on better information, NDPs might be adjusted."

The object will be to set NDPs to strike a balance between safety and economy, but where there is information to support changes that may result in more economical designs, it will be possible to choose values for NDPs to allow engineer to take advantage of this.

He added: "Because the codes have been in development for so long, people already know pretty well the areas where we should focus efforts."

Results will be presented to BSI committees for scrutiny, and the annexes will be circulated as drafts for public comment. It is expected that the entire process will take about 18 months, allowing the National Annexes to be published in 2007.

Legal landmark gets complex design

Erecting unusual cantilevered 'fingers' is one of the main challenges facing steelwork contractor William Hare at the new Manchester Civil Justice Centre. The landmark structure, designed by Australian architect Denton Corker and Marshall, comprises three concrete cores with steel superstructure.

The building will be the new headquarters for the Department of Constitutional Affairs in the North-West of England and will include around 50 courtrooms. It is the biggest court complex to be built in the UK since the Royal Courts of Justice in London.

Mark Thompson, Structural Team Leader with engineering designer Connell Mott MacDonald (CMM), says there are huge complexities in the design and construction of the glazed cantilevers. These are fully welded truss frames, made up of universal column sections and fabricated I-beam sections, that extend by up to 15m.

Each cantilever carries a complex combination of compression and tension, says Mr Thompson. Resulting out of balance forces are carried by two of the concrete cores, while a single core in the middle of the 16-storey structure provides the main lateral stability.

For health and safety reasons the cantilevers, currently partly installed, are constructed off-site and brought to the project as partly assembled units.

CMM carried out 3D structural modelling and analysis using Staad software, in which particular attention was given to the assessment of floor vibration. Given the big open floor spans, unusual for a core building, analysis included the effect of large numbers of people walking around.

For this, CMM brought in bridge designers to help assess the dynamic response and included a damping beam to reduce the natural vibration frequency of the floor.

A number of unusual voids and openings needed because the building is designed to be naturally ventilated and to maximise use of natural daylight added to the complex distribution of forces.

A dramatic feature is the use of slender triangular columns within an 11-storey atrium, with a 60m by 60m glass facade along the building's western edge. The building is due for completion in 2006.

Doncaster's boost for education

Construction of a major extension to Doncaster Further Education College is under way, to provide a £71M state of the art education complex on the banks of the river Don.

The development consists of two blocks of five and six storeys connected by steel footbridge links and observation areas. Distinctive roof cantilevers over the entrances to both buildings will be supported by full height circular hollow section columns.

Bone Steel has won the contract to design, fabricate and erect 3200t of structural steelwork, including cellular beams and trusses.

Main contractor is HBG; architect is DLA Architecture, and structural engineer is Arup.

Europeans learn secret of growing UK steel market

European steel industry firms have visited London to learn how they can raise their market shares in multi-storey steel construction to the heights enjoyed by the UK industry. At a workshop in May delegates from several European countries heard from Corus and the BCSA how 20 years ago the UK steel construction industry combined forces to overcome key weaknesses in the sector, leading to its dramatic capture of market share in the multi-storey building frame market.

European steel counterparts have some way to go to match the success of the UK industry. The European Convention for Constructional Steelwork workshop was intended to help them learn from the UK's experience. Corus Construction and Industrial's Roger Steeper told the workshop that 20 years ago steel had a number of key weaknesses which meant it had a very low share of the market for high-rise construction. "These weaknesses were each addressed and the information relayed to those people that could use it. Fire and its protection was a major issue for steel back then, but the problem was mainly based on a lack of understanding. Some major research provided the missing knowledge and so the market began to expand, facilitating innovation and advancement of better products and techniques, which in turn accelerated the growth."

Caunton Engineering Marketing Director and BCSA Marketing and Membership Services Committee Chairman Geoffrey Taylor described how the steelwork contracting industry added value by development of just-in-time manufacture, encouragement of integration of following trades, constant attention to health and safety and a readiness to accept new ideas have led to improvements in speed, development of a 'one-stop shop', integration of fire and corrosion protection, more flexibility and increased competitiveness. Mr Taylor said "The campaign was market focussed and involved steelwork contractors, the associate members who make steel decking and edge protection, stud welders, and companies such as Fabsec and Westok who make bespoke beams."

As a result steel accounted for 71.7% of the high-rise office market and 43.5% multi-storey residential market in 2004.

UK steel for Hong Kong terminal

Roof erection on Hong Kong airport's HK$2bn (£130M) SkyPlaza terminal is set to begin this month using steel supplied by Corus.

The main steel component to the development is a 168m by 220m orthogonal truss roof, which is supported on a 36m grid of concrete columns. The trusses are trapezoidal in section, made up from circular hollow sections, and spaced at 12m centres.

A second steelwork structure above this supports automatic smoke vents and daylight windows in a saw-tooth roof arrangement.

Andy Hodgkinson, Regional Director with structural engineer Tony Gee & Partners, said the construction team is working to a very tight schedule to make the building weather-tight by October. He adds that a contractor-focused approach led to "a number of key alterations to the roof design in order to reduce risk to the construction programme and improve buildability." This included modification of the concrete column to steel truss roof connections and use of bolted site truss connections.

Tony Gee & Partners generated 3D drawings of the complex geometry using X-Steel.

Chun Wo-Fujita Joint Venture is main contractor on the project, which is the largest building project currently under way in Hong Kong. It is also the single biggest contract at the airport since it opened in July 1988.

SkyPlaza, located on the east side of the existing terminal building, will house the airport's second passenger terminal which is geared up for tour groups and passengers traveling to and from mainland China.

The multi-level complex will have a gross floor area of 140,000m^2, housing a variety of facilities for passengers and other airport users, including a substantial commercial land-side development, with shops, cafes and even an IMAX cinema and auditorium.

AROUND THE PRESS

Construction News
28 April 2005
Government efforts to drive down the cost of new homes will boost the use of steel in housebuilding, say constructional steel bosses. The Government's target to build quality homes for £60,000 will increase the number of steel framed houses built in the UK, they claim.

Building
13 May 2005
...the famous Bird's Nest stadium of Herzog & de Meuron and Arup, the showpiece for the 2008 Olympiad... The nest effect will be achieved with steel: 24 primary box girders 1200mm wide, with secondary members attached irregularly. The 42,000 tonnes of steel will be fabricated offsite, which will take six to nine months, and installation is planned to take 370 days.

The Architects' Journal
19 May 2005
When Whitbybird was appointed as the structural engieer on the Turner Contemporary gallery in Margate... one of the first moves was to persuade the architect to change from its original choice of materials to steel, so that shipbuilding techniques could be used. After all, ship designers and builders know how to deal with exactly the conditions that Turner Contemporary will encounter in the worst of the winter storms. Like a steel ship permanently at anchor, the gallery will consist of two steel welded skins, separated by curved steel ribs.

Construction News
19 May 2005
Structural steel producers have warned contractors to be wary of substituting hollow sections for cheaper material. They underlined the difference in performance between hot rolled structural hollow section steel and cold formed substitutes and claimed the accidental use of cold formed steel could put structures at risk.

Hospital Development
20 May 2005
Steel is becoming the first choice construction framing material for healthcare buildings. Standard steel floor designs now easily meet strict NHS vibration criteria, removing what was once seen as a potential drawback to their use.

September showcase for Beijing Olympic bidders

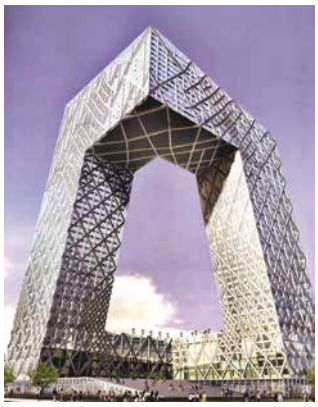
The China International Steel Construction Congress and Expo in September will be an essential event for anyone considering bidding for work on the 2008 Olympics.

The Expo, which last year attracted 7000 professional visitors with 176 exhibitors and 9000m^2 of exhibition space, will allow companies with an interest in the Olympics to display their expertise. Expo themes include membranes, stainless steel, computer aided design and space structures, as well as welding and fastening, and steel housing.

The Congress, which runs at the same time, promises to bring together structural steel producers and government officials with professionals from design, building, contracting and consulting. The conference programme suggests delegates will "benefit first-hand from Olympic 2008".

BCSA director-general Derek Tordoff said: "Anybody with half a mind on winning some work on the Olympics, whether steelwork contractors, general contractors or designers, ought to go."

A highlight of the conference promises to be a presentation, by Chen Luru of China's expert committee on steel structures, on the new headquarters for China Central TV. Commissioned specially for the Olympics and designed by Arup, the 54-storey building has a 120,000t steel exoskeleton. It consists of two vertical sections leaning at 6deg, joined by a 15-storey horizontal link at the top and another at the bottom.



China Central TV's new HQ for the Olympics will be the subject of a conference presentation.

ESCDOT clears first hurdle

A new on-line training platform for specialist steelwork designers using the Eurocodes won approval at a workshop to review its pilot phase last month.

Progress on ESCDOT (Eurocodes for Steelwork Contractors: Designers Online Training) was 'well-received' by members of the BCSA's technical committee.

The two-month pilot was funded by a £60M grant from the DTI Training and Skills programme. The main aim was to develop a platform or framework for the website which would effectively communicate the design approach under the Eurocodes to specialist designers.

Attention now turns to producing the technical content for the on-line platform. This will focus on low-rise frame stability, the effect of wind loads and connection design.

BCSA technical consultant Dr Roger Pope said that the aim would be to bring the site on-line to BCSA members over the next 18 months to two years, on the same timetable as the National Annexes to the Eurocodes and other design guidance.

The initial grant came from a programme concerned with developing training tools rather than technical content.

Dr Pope said: "A call for further resources would require support from the BCSA and its members and we would be hoping that there may be suitable DTI support programmes. It would be more efficient for the steelwork contractors to pool their resources rather than each of them making provision for training individually."

However Dr Pope hoped that the project could tap into design guidance already being developed within the industry. "We may be able to link in and convert that to an electronic format relatively easily," he said.

Sustainability takes centre stage at Steel Construction Conference

British Land head of construction Richard Elliott will deliver the keynote address on 'The Client's View of Sustainable Steel Construction' to the Steel Construction Conference and Exhibition on 15 November.

The Steel Construction Sustainability Charter will be launched at the event, unveiling the industry's definition of sustainability. Companies will be able to subscribe to the charter to denote their commitment to sustainability targets. Their performance will then be subject to an annual audit.

Other presentations will include project case studies in the bridges, hospital, school and multi-storey residential sectors, and the Eurocodes. There will be 30 exhibitor stands.

John Humphrys, of Radio 4's Today programme, has already been signed up to chair a panel discussion of future trends in the UK construction market.

The conference fee of £160+VAT includes a copy of a new book on Steel Construction Details.

Avant-garde geometry takes wing

Rowecord Engineering has supplied 350t of structural steel for TAG Aviation's new executive terminal at Farnborough Airport.

The terminal, which will be frequented by celebrities and business leaders, is the third and final project to come out of a design competition that the client implemented to bring avant-garde structures to the former MoD owned facility.

TAG took over the Hampshire site, once the base for the UK's aircraft research industry, in 1998. Since then is has been successfully developed as a dedicated business airport serving south-east England, as well as hosting the biennial Farnborough Air Show.

Fittingly, the shape of the Reid Architecture designed terminal echoes an aircraft wing. It is formed by nine large steel hoops which

support the complex geometry of the building envelope.

Rowecord Technical Director Paul Benwell said: "The form of the structure and its essential dimensions change on every plane." Structural designer Buro Happold says that use of 3D CAD modelling proved invaluable in helping fabricators understand the complex geometrical issues.

Erection was completed in 14 weeks with a team of four men supported by a second team for the finishing touches. Fire protection is provided by intumescent coatings applied on site, supported by the secondary protection of concrete-filled hollow section columns.

Engineering skills bodies to combine

Merger of the two leading skills organisations in the engineering and metals sectors will create a new body capable of building on both organisations' strengths.

So said Lindsay Millington, chief executive of Metals Industry Skills and Performance (MetSkill), which last month announced plans to merge with the Science, Engineering and Manufacturing Technologies Alliance (SEMTA).

MetSkill's focus has been on developing the strategic skills base of the metals industry, including steel making and processing as well as steelwork contractors. Its strengths have been in working with employers to boost skills and productivity.

SEMTA, the larger organisation, is the sector skills council for science, engineering and manufacturing technologies, with a focus on manufacturing firms. Sector skills councils are the government's preferred channels of communication with industry on training issues. SEMTA operates more at national and regional level, seeking to influence government and developing occupational standards and qualifications.

"The two organisations differ but we have a variety of strengths which put together will produce an organisation bigger and better than both of us," said Ms Millington.

She added that MetSkill members should not be concerned about a loss of influence in the merged body: "One of the benefits will be increased influence with policymakers nationally and regionally." There will be "a strong representative structure" in the new organisation for employers from the metals sector, including two seats on the board.

Details of the merger are still being finalised, although the new body will still be called SEMTA and chief executive Philip Whiteman will remain in that post.

Sirhowy deck complete

Fairfield-Mabey has erected the final section of deck steelwork for the Sirhowy cable stayed bridge in South Wales allowing cable installation to begin during an unusual construction sequence. Deck steelwork has been lifted on to temporary steel trestles while the bridge's single pylon is constructed, instead of the conventional method of adding deck sections incrementally as cables are stressed.

Composite deck construction with the steelwork temporarily propped has been selected by Arup and Costain for a faster construction programme. All the main deck steelwork is now in place ahead of cable work. Deck slab construction is also starting on an Omnia plank system in preparation for casting the deck after the cables have been stressed.

Costain and Arup form the Sirhowy Enterprise Way consortium which has a 30 year Design, Build, Finance & Operate concession for 4.3km of new roads and bridges, including the 227m long cable stayed crossing of the Sirhowy valley.

NEWS IN BRIEF

Atlas Ward Structures has been awarded the contract to fabricate and erect 900t of structural steelwork for Aylesbury College.

The £30M project will replace buildings dating back to the 1960s, and is due to open in time for the autumn term in 2006. Main contractor is HBG Construction.

Software provider CSC will be creating interactive worked examples for the pan-European STEEL (Supranational Tool for the Enhancement of the Eurocodes on-line) project. CSC's structural engineers will use its TEDDS software to create worked examples in which users can experiment by entering their own design data. A custom version of TEDDS will be freely distrbuted to allow engineers to use the examples.

ITN Political Editor **John Sergeant** will be the guest speaker at the SCI Annual Dinner in London on 10 November. Alongside a 35-year career in journalism Mr Sergeant has latterly developed a parallel career in light entertainment, on such shows as *Have I Got News for You*, and as an author.

European Union steel output will decline by 1.5m tonnes to 192m tonnes in 2005 while Chinese production will rise by 17% to 315m tonnes, says consultancy MEPS. Stockholders and other customers are said to be holding large reserves, which will give producers a breathing space to renovate plant. World growth in steelmaking capacity of 4.5% is predicted for 2005, half the growth rate of 2004.

Corus has started delivery of steel composite floor decking to a new terminal at Charles de Gaulle airport, Paris. Over 74,000m^2 of decking is being supplied to the new Terminal 3 building, including 7,000m^2 for walkways.

Letters

NSC welcomes letters from readers on steel construction related issues. Please keep your letters brief — the Editor reserves the right to condense. Address your letters to: The Editor, NSC, BBA Linden House, Linden Close, Tunbridge Wells, Kent TN4 8HH. Fax: 01892 524456. e: info@new-steel-construction.com

Safety designed in

Peter Walker's observations on the upcoming changes to the CDM regulations (News p9) in NSC's May edition once again brings the whole subject of CDM and our respective roles as designers back into the spotlight. The new regulations will further emphasise the designer's role, a role that still, despite all the recent HSE initiatives, very few of us fully appreciate. I have been particularly interested in the whole aspect of the role of a designer under CDM, and whereas I too as a steelwork contractor was dismissive of our ability to affect site safety by design, the more I have considered the issue the more I firmly believe we can actually influence.

Such aspects include holes for edge protection being incorporated at fabrication stage, erecting the edge protection at ground level and lifting with the steelwork, the use of lifting cleats and proprietary shackles, limiting working at height, real consideration of temporary stability issues the list is endless. My one fear is yet again the changes to the regulations will produce an even greater plethora of paper and plunge what could be a real opportunity to improve site safety into a further tick the box exercise that blights the current regulations.

Steve Fareham
Managing Director
Billington Structures

Steel ideal for housebuilding

I read your report on the contribution that steel can make towards meeting the government's challenging housebuilding targets in your May issue with interest.

The challenge facing the housing construction industry is clear: increase output from 21,000 to 35,600 units per year and at the same time reduce the energy footprint of housing by 60%. Where is this increase in output to come from? Do we continue to drive up effieiency in the current industry? Do we import a workforce from abroad? Do we import houses, lock stock and barrel, from abroad? All of the above are possible, but there is another option: we can create a house manufacturing industry to fulfil the demand; not manufacturing homes based on the experience of our housebuilders, but one based on a different premise, fulfilling the desire of each buyer to own their own tailor-made dream home.

Modern manufacturing can make a batch of one: instead of mass-production we can have mass-customisation. Instead of everyone's home being the same as their neighbour, they can all be unique.

Where does steel fit in? It is the ideal manufacturing material, you can bend it, cut it, pierce it, curve it in two dimensions and it retains its integrity; you can use it to hold a building up, to protect the roof and to clad it: the possibilities are almost endless. Just imagine, if you will, a row of semis clad in weathering steel, a street of townhouses resembling something from the Mercedes factory and a tower like the Swiss Re but full of apartments. Yes, we have made progress, but there is a world of opportunity waiting.

Rory Bergin
Director IT
HTA Architects Ltd, London

Pay when payment is due

I fully endorse Marion Rich's comments on the Construction Act in your May issue. Continuing payment difficulties in the industry prompted the review of the Act. Payment delays and abuse are endemic in the industry because everybody is living off everybody else's credit. As one moves along the supply chain the credit periods get longer and longer, with the smaller companies bearing a disproportionate burden of the financing.

This state of affairs has its price. If everybody were paid on time and without credit being given, the industry could save almost £2,000M a year. This figure is based upon the savings made on a recent Defence Estates project at the Faslane submarine base. The project was worth £90M and the savings were almost £2M as a result of everybody being paid on time.

There are two key messages for the government. The first is that we must have certainty of the time and the amount of payment to be made. This means that we must include within the Construction Act a very simple payment procedure that gives rise to an enforceable debt, which gives a statutory right to apply for payment. The second message is that we must have security of payment. This includes starting the payment process from the date of the agreement to commence offsite activity such as steel fabrication, getting rid of pay when paid, and providing protection against insolvencies.

It is now vital that we respond to the consultation documentation and make our views known.

Professor Rudi Klein
Chief Executive
Specialist Engineering Contractors Group

Diary

From 16 June
Steel: The Show - A series of free seminars from Corus Construction & Industrial covering a range of topics related to steel design and construction. 16 June London, 28 June Glasgow, 30 June Manchester, 13 July Southampton, 22 Sept Dublin, 12 October Durham, 19 October Scunthorpe (including optional steelworks tour). To register interest please visit www.corusevents.com.

23 June
Structural Steel Design Awards Luncheon Savoy Hotel, London. Winners of the 2005 awards, sponsored by Corus, the BCSA and the SCI, will be announced. Contact: Gillian.Mitchell@steelconstruction.org

20-21 September
Architecture and Steel International Symposium, Palace de la Méditerranée, Nice (part of the ECCS 50th anniversary event). Presentations will be given in English. Further details available at www.scmf.com.fr

26-29 September
The Fifth China International Steel Construction Expo, Beijing. The accompanying Congress runs from 27–28 September, Further details: www.constex.com/en/home.asp

10 November
SCI Annual Dinner
Landmark Hotel, London. Guest speaker, John Sergeant
Further details: Liz Chamberlain l.chamberlain@steel-sci.com

15 November
Steel Construction Conference
The Brewery, Chiswell Street, London EC1. Organised by BCSA. Contact: Gillian.mitchell@steelconstruction.org

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Intumescents reducing developers' costs

Nick Barrett reports from a London seminar which launched the new design and contractual guidance for offsite application of intumescent coatings.

One of the big development successes of the past decade has been the growth in demand for offsite application of intumescent coatings. As recently as 1996 when the first edition of the offsite applied intumescents guide — Structural Fire Design: Offsite Applied Thin Film Intumescent Coatings — was published there was little offsite application to speak of. However a few pioneers were beginning to prove that it could be scaled up for large projects with significant savings in terms of the construction programme and quality of application. Now, over 50% of multi-storey fire protection in London is offsite applied intumescent coating.

Seminar Chairman John Dowling of Corus Construction and Industrial said some 75,000 tonnes of structural steel had intumescent coatings applied off site in 2004. The popularity is mostly a southern and south east phenomenon. 'There is lots of scope for increasing market share in the north where only about 7-8% is offsite applied,' said Mr Dowling. 'The total market share is about 23%.'

The updated model specification is a new edition of SCI P160, launched by the Steel Construction Institute as the old one has been overtaken by the rapid success of offsite intumescents. Dr Ian Simms of SCI explained that the new guidance has been designed to more accurately reflect current standards, procedures and expectations of the structural steelwork industry. He said the first edition provided a new industry standard for the use of offsite applied intumescent coatings, and by presenting a model specification it was hoped that greater uniformity could be achieved in contract specifications.

In 1996 coatings were thicker, and bigger sections were sometimes specified to allow a thinner coating to be used. There have been significant advances in the technology since then, however, and coatings have been on a trend towards thinner and cheaper.

Barry Dobbins, Senior Associate Director of Waterman Partnership, told the seminar that most of his firm's projects involved offsite application. A composite steel frame with intumescent fire protection is the preferred choice for most developments with a high degree of services coordination, he said. Maximum use of offsite fabrication processes had to be used to optimise on the construction programme. 'The use of intumescents externally can assist in the expression of structural form. The structure can be integrated into the cladding zone. It can allow incorporation of a diagonal structure into a façade, for example. Internally it can be just as effective.'

Other benefits for developers included reduced construction cost, reduced frame size, reduced cladding and reduced fit-out costs. In sum, a better return on their investment for developers.

Clive Newman of Fire Safety Engineering Consultants said intumescents were originally developed in China in ancient times and were pioneered in the UK in the 1970s. The success of offsite application was virtuous circle, where growth in the market provided opportunities to develop better materials which in turn prompted more market growth.

Ian Wells, Commercial Director of Site Coat Services, said his company only does offsite application. On-site application should be executed by skilled craftsmen but in the wrong conditions the coatings could fail. Quality was more easily assured when application was in offsite factory conditions.

The guide is available to download as a Word document from www.steelbiz.org

Dowling bows out on a high note

Outstanding engineer, academic, entrepreneur, humourist – Professor Patrick Dowling CBE, one of the steel sector's most eminent protagonists, retires this summer. Ty Byrd reports.

Professor Patrick Dowling was awarded the CBE in 2001. He was President of the Institution of Structural Engineers, 1994-1995. He has received national and international honorary degrees, awards and accolades too numerous to be mentioned in this article.

Snap Professor Patrick Dowling in half like a stick of rock and you will find *Imperial* written there, so he says. He spent 33 years at "the best faculty of engineering in Europe", for many years sponsored by the steel industry, which he paid back in spades. Steel plates, box girders, bridge decks and tension leg structures for the North Sea spring to mind. He was chairman of the steel Eurocode committee for 13 years. Latterly, he has been prime mover in the transformation of the University of Surrey into one of the most financially robust and best seats of learning in Britain. You would think such a man might be aloof and difficult to approach, but far from it.

Paddy Dowling is friendly and funny and entertaining to be with. He is renowned for his sense of humour. "Paddy should be pompous, given his intellect and achievements, but he is far from it," says a friend and former colleague. "I believe it is his upbringing in Ireland that is responsible. There is a real sense of the Irish about him."

Dowling was born in Dublin in 1939. The early death of his father from Great War injuries left Mrs Dowling with six children, all of school age. "Her educational philosophy was simple and effective: the girls went off to boarding school, the boys to the Christian Brothers School to have the corners knocked off them. They were champions of education and totally dedicated. I found them very inspiring." In his Leaving Certificate, he got 105% for applied mathematics, having been given a 5% bonus for answering in Irish and then getting everything right.

Bright young people in Ireland in the 1950s were encouraged to study engineering. Dowling had the right qualifications but the wrong age – at 17, a year ahead of his class, he was too young to enter university. He spent a year at Dublin's Institute of Technology "kicking my heels and discovering girls" before entering University College to undertake a four year degree in engineering. After a month of studying, he felt it necessary to see his Professor to ask what, exactly, civil engineering was. "He told me it was roads and bridges and so on, public works. I said, 'I'd like to do that.' He said: 'You are.'"

Dowling did well, winning a scholarship every year which meant his fees were paid. A First at University College plus a year working there as a Senior Demonstrator (assistant lecturer) led him to a scholarship to Imperial College, London, to study structural engineering. Sponsorship by the British Iron & Steel Foundation plus the British Constructional Steelwork Association meant convincing three academics – Tony Flint, Jack Chapman and Rob Sparkes – and also the BCSA's Charles Grey of his bona fides. Grey asked the killer question: "What bloody use are you going to be to the British steel industry?" Dowling's reply – "I am very bright, I can help and goodness knows, you need all the help you can get" – was deemed appropriate.

"This was fascinating and brilliantly taught, by exceptional people, the very best of their generation."

Dowling was to spend 33 years at Imperial College. He worked for three years towards his PhD with Jack Chapman, conducting research on steel bridge decks. Then came three years away from Kensington, working for the BCSA as its bridge engineer, most of the time designing steel alternatives for clients who were more naturally inclined to think concrete. "People were not aware then of the benefits of steel, that it could actually offer more efficient solutions."

The British Steel Corporation's Sir Monty Finniston wanted to attract the best people into the steel community and the corporation raised funds for fellowships. Paddy Dowling was invited to become a post-doctoral research fellow, to work with his former mentor Chapman. This was in 1970. Close to two and a half decades of sponsorship followed, with Dowling on the staff of Imperial as lecturer, reader and – from 1979 to 1994 – Professor of Steel Structures, by then paid for by British Steel. From 1981 to 1989 he was also head of the Engineering Structures section; and from 1985 to 1994, head of the Civil Engineering department.

Over the years, he made his name as a structural engineer of pre-eminence, and also as a builder and motivator of teams. Through compilation of data on the ultimate behaviour of steel box girder bridges,

Dowling's career included involvement in offshore structures.

he had much to do with the Merrison rules, applied to all such bridges in Britain following the failures at Milford Haven, Yarra and Koblenz.

His interest in flat plates moved to curved plates and seamlessly to offshore structures.

By the beginning of the 1990s, Dowling was ready for change. He had spent more than a decade as chairman of Eurocode 3, having put the committee together, for a long time combating UK government belief that such a code was not needed: "Isn't BS449 being used all over the world?" he was asked.

He had worked on many major projects, including the Thames Barrier. He had seen his own consultancy, established with Jack Chapman, flourish.

He turned down the position of Principal of University of Wales College Cardiff: his wife did not want to give up her successful medical practice. "As I owe her everything, I had to listen. We didn't move. But I thought, hmm, if ever the VC's job becomes available at Surrey in nearby Guildford, that might be a different matter." The opportunity did present itself and Dowling grasped it in 1994.

The role at UniS, as it is now called, includes being Chief Executive, a role in which he has again excelled. "We have repositioned and restructured ourselves," he says.

Turnover in 1994 was £65M, today it is £156M. Student numbers have doubled. Some £200M has been invested in buildings on campus. The range of quality and research has grown. The university's Research Park now releases sufficient money to enable UniS to make rude gestures towards government, if it wanted to. "With the exception of London Business School, no-one is less dependent on government funding than we are." A substantial new campus is under development. The interface between the university, business and industry is very close: "It has to be. I see the need and benefits very clearly, having been sponsored by industry myself for 24 years."

So what now? Paddy Dowling retires this summer. On the 23 and 24 June 2005, UniS is hosting an international symposium on innovative and sustainable steel construction in his honour. Top rate speakers from around the world include a good number of Paddy's own PhD students. "I really do feel honoured," he says. Standing down means he will have more time to pursue his interests in the visual and performing arts and on work with various charities. "I might also spend a little bit more time in Ireland."

Ultra clean operations in Sunderland

The four storey structure will provide five new operating theatres, sterilising services and a mortuary

Healthcare for residents of the Sunderland area is receiving a boost in the shape of an extension to the city's Royal Hospital, where steel is reducing construction time and helping produce ultra-clean operating environments

A new extension to Sunderland Royal Hospital's operating theatre wing is rapidly taking shape. When complete it will provide a range of new clinical facilities for day care patients.

The 15,000m², £8.5M five-storey Block C extension's second and third floors will house three general operating theatres and two ultra-clean theatres, with day wards and recovery suites above that. The top floor will house plant. Sterilising services including washers, disinfectors and autoclaves for operating theatre instruments will be sited on the first floor. All of these will be accessed from the existing building, and in addition there will be a mortuary with its own separate entrance on the ground floor.

Steel was chosen in part to match to the existing building: the new construction connects to a smaller extension dating from the late 1990s which is also steel-framed.

There were a number of other factors in steel's favour. Kier Northern Project Manager Nigel Moore says: "A steel frame is a lot quicker in programme terms. From an environment point of view, building an insitu frame would have meant many more wagon movements and congestion around the hospital." This is especially important given that the site is constricted.

In addition, from the standpoint of limiting vibration in the existing hospital, a steel frame had the advantage that it could be built initially as an independent structure and connected later. Similarly, erection of a garage unit is being delayed till later in the programme, until after the brickwork façade of the main building has been completed.

Initial design of the new extension was carried out by the client's in-house design section. To use the expertise of the main contractor and subcontractors the scheme was let to Kier as a disgn and build contract. Kier employed Arup to act as structural engineer. South Durham Structures is responsible for steelwork fabrication, and erection of the steel frame and decking.

The frame, which comprises 450t of steelwork, employs asymmetrical beams supporting Slimdek flooring, which allows a generous 3.3m floor to ceiling height as well as simplifying fire protection.

The structure is built on a varying grid of 8.0m in one direction, up to 6m in the opposite direction Columns are 254 UCs spliced 1500mm above second floor level. For the floors 225mm deep Slimdek units are used. The 300mm deep x 185kg/m asymmetrical beams are substantial sections with 30mm flanges and 30mm webs. Flat cross-bracing in the stair cores provides lateral stability.

Use of Slimdek means that no fire protection to the beams is needed, as they are cast into the structural topping. Only their lower flanges are left exposed but it is not necessary to protect these to achieve a one-hour fire rating. Columns will be enclosed in plasterboard.

Pouring the structural topping for the floors started

FACT FILE
Sunderland Royal Hospital
Client:
City Hospitals Sunderland NHS Foundation Trust
Design and build contractor:
Kier Northern Ltd
Structural engineer:
Arup
Steelwork contractor:
South Durham Structures Ltd

Steel tonnage:
450t
Contract value:
£8.5M

Space on the site is limited because of the need to maintain access to the hospital car parks

The composite floors use Slimdeck steel decking

in May. The two widest bays are at the limit of the Slimdek unit's spanning capability so that they will need propping in the temporary condition while the structural topping is being placed and is curing.

"We were really pushing the spans so there's a need for some propping," says Arup Project Engineer Svend Trinder. Arup investigated a number of strategies to avoid this, such as two-stage pour, initially pouring concrete to the depth of the Slimdek ribs and then adding the rest of the structural topping later.

"We tried extremely hard to push back the frontiers, working with Corus to try to avoid propping. We almost got there but it was not quite possible." In the end there was not enough experimental data to be sure that the flooring system would perform as expected under these unusual conditions, says Mr Trinder, and he suggests that a research project could usefully look into this question.

The drawback is that propping slows the programme somewhat. Each floor has to be propped via the floor below down to ground level, which means that concrete on any given floor has to achieve its 28-day strength before the floor above can be cast.

The construction team looked at options such as adding an accelerator to the mix, before deciding to increase the concrete grade from 35 to 40, so that the nominal 28-day strength will be reached more quickly.

As with all hospital buildings, noise and vibration have had to be taken into account both in design and construction of the building. "In the operating theatre the floor slabs are thicker than elsewhere, primarily to take the weight of operating theatre equipment," says Mr Moore. "As a secondary function this also reduces vibration."

But noise and vibration is more of an issue than normal in the construction process, because, as South Durham Structures Contract Manager Derreck Pinkney points out, "There are live operating theatres three metres from where we're working."

SDS started work at the end of February, but though 90% of the steelwork is now complete, the most challenging aspect of the contract still remains.

The new extension has initially been built as a separate, independent structure, so vibration during this phase was not too serious a problem. "The more difficult question is connecting to the existing building, when any vibration will go straight through," says Mr Pinkney.

A total of 33 linking steel beams have to be attached in conjuction with the removal of existing cladding and demolition of the blockwork. This is not due to start until late July, after the floors have been completed.

The contractors have been informed of downtime slots when the operating theatres will be undergoing cleaning or maintenance, though these slots are only 45 minutes to an hour long. A hot line has been set up from the hospital so that work can be stopped if it threatens to affect an operation. Some of the work such as the demolition of the existing wall will take place overnight.

The majority of the steel connecting beams at first floor level have already been installed. An external flashing was removed to reveal the existing hollow section beams. Fin plates were welded to the existing beams and the connecting members bolted in place.

Access is limited, with only 2.2m between the old and new buildings. Mr Pinkney plans to deal with each floor on a progressive basis, using a scissor lift to install the linking beams to the next level.

The other outstanding task for South Durham Structures is to build the two-storey plant unit, after the main façade brickwork is complete. "This means we can build the façade from mast climbers rather than having to scaffold the building," says Mr Moore.

The new extension is due to open in April 2006, providing a welcome boost to the city's healthcare facilities.

The extension has been built as an independent structure with the connection to the existing building to be completed later

Fast track for New Forest hospital

Construction of a new private finance hospital for Hampshire, due to open next year, is comfortably ahead of schedule thanks to a steel frame structure.

Lymington New Forest Hospital is a community rather than a general hospital and will provide 104 beds with four wards and two operating theatres, treating patients mainly on a daycare basis.
It will replace an existing community hospital and is being built under a £29.8M PFI contract by Ryhurst, with associate company Rydon Construction as main contractor.

Steelwork contractor Atlas Ward Structures completed erection of 500t of structural steelwork and 8000m^2 of metal floor decking towards the end of April.

Peter Blewett, Principal Engineer at structural engineer Upton McGougan, says: "We designed Lymington with a steel frame because it is a clean, reliable, quality assured product which can met strict NHS standards for acoustic insulation and vibration levels."

In addition steel provides greater flexibility to form additional holes if it proves necessary to modify or extend services later.

The project comprises two buildings on a 3.72ha greenfield site. The main hospital building has wards on three storeys, a two-storey Diagnostic and Treatment Centre, and a two-storey-height entrance area. A separate single-storey building will provide the hospital's energy, waste and management centre.

The Diagnostic and Treatment Centre is organised around a double height atrium-style waiting area, from where it will be possible to see the reception areas of the various departments. It will have full height curtain wall glazing overlooking a courtyard on one side.

Structurally the hospital building is straightforward, consisting of UBs and UCs on a 7m grid, extending to 7m x 9m in the operating theatres, and with composite floors formed with Kingspan decking.

Vibration analysis of the structure was more

The main hospital building includes the two-storey Diagnostic and Treatment Centre and wards to three storeys

The new community hospital will provide 104 beds. A Diagnostics and Treatment Centre is organised around a double height atrium and courtyard

complex, and Upton McGougan enlisted the help of the Steel Construction Institute. The SCI's Dr Stephen Hicks has recently developed new guidelines for predicting the vibration response of floors.

The new guidelines were the culmination of a six-year research project. Through tests and back analysis of existing structures designed to the long-standing SCI 076, 'Design guide on the vibration of floors in hospitals', the SCI has developed a sophisticated analysis model to predict responses for floors. On the basis of this model SCI published its new version of the guidelines.

But Dr Hicks says: "The guidelines are fine for a regular floor grid but when you have a special case you may need to go back to the more sophisticated model." The Lymington project has a non-uniform grid, numerous slab penetrations for services, and movement joints. This put it beyond the scope of the simplified analysis, says Dr Hicks.

From Upton McGougan's plans, Dr Hicks developed a finite element model of the steel frame which was used to predict the dynamic properties of the floor. This data was then exported to software developed by SCI, which is used to simulate the effect of people walking along corridors and to determine the response factors of the wards and operating theatres. "We were able to rate response factors in sensitive areas and advise on whether the initial design was OK, or whether it needed refinement in certain areas."

The results were that in the ward areas, the structure met the requirements of Health Technical Memorandum 2045. For the operating theatres, the SCI worked closely with the engineer and the requirements for these areas were met by thickening the slab locally and increasing the sizes of the UB sections in this area.

Atlas Ward began steel erection in February and finished in late April two weeks ahead of schedule, and the company is hoping this will lead to other work. "This was our first job for Rydon and we've now won another job, on a hospital in Epping which is due to start in July," says Atlas Ward's Peter Church.

The whole project is now reported to be four weeks ahead of programme, which bodes well for meeting a completion date of November 2006.

See technical feature, page 28

FACT FILE
Lymington
New Forest Hospital
Ultimate Client: *New Forest Primary Care Trust PFI*
Main contractor: *Rydon Construction*
Architect: *Murphy Philipps*
Structural engineer: *Upton McGougan*
Steelwork contractor: *Atlas Ward Structures Ltd.*
Steelwork tonnage: *500t*
Contract value: *£29.8M*

Grand design becomes reality

When City financier Julian Simmonds was unable to find the perfect London apartment for himself and his family he decided to build his own. The smart money backed a steel frame for what will be one of London's most exclusive developments, reports David Fowler

Above: The Victorian facade was retained from the original building

More and more people are nowadays realising a dream to build their ideal house, but Julian Simmonds has taken the idea to a completely new level.

Searching for a London apartment, the former executive vice-president of Citigroup found to his frustration that nothing on the market seemed to meet his requirements.

Then, by chance, he noticed an empty former King's College building, whose elegant Victorian façade stretched for over 100m along Manresa Road in Chelsea. He decided it would be ideal, bought it and gained planning permission for redevelopment.

By the end of this year it will have been transformed into London's most exclusive and luxurious residential development, its 15 duplex, triplex and penthouse apartments offering buyers the sort of clear space hitherto only found in Docklands lofts.

Below: Cherry-pickers with articulated arms could reach across the 13m bays

Behind the retained façade of the original 1895 building, steel has been adopted as the construction material most suited to creating the clear spans needed to give residents the maximum freedom in how they use the interior space.

Mr Simmonds and co-developer Candy and Candy describe the development as "eight star": taking as the benchmark in quality the world's most luxurious hotels such as the seven-star Burj Al-Arab in Dubai, George V, Hotel de Paris and the Bellagio, it indicates that Manresa Road goes one step better.

For the residents, who will start to move in later this year, the multi-million pound purchase price will be just the start. The apartments are being sold on a 'shell and core' basis at prices from around £7M–£15M and buyers can expect to lay out another £7M or so for fitting out.

21 Manresa Road will offer residents, Mr Simmonds says, "flexibility, huge rooms, an M&E specification that's never been done before and a flexible structure. The quality will be unprecedented in the residential sector, and residents will have the flexibility to create big spaces." Others seem to agree such a mix is missing from the market, as there seems to be no shortage of potential buyers.

The new structure is divided into eight 13m wide bays running from front to back and will comprise just 15 apartments: eight single width triplex (three storey) units, four double width duplex units, and three triple width penthouses. There is a raised ground floor, a first floor, a mezzanine level and a second floor. Room heights, dictated by the existing windows of the façade, will be in the region of 4m.

From art school to prestige address

21 Manresa Road was designed by the architect J M Brydon and completed in 1895 for South-West London Polytechnic. During the 1930s it became Chelsea School of Art. In 1985 the building was transferred to King's College London, which used it as a research facility until 2002.

Only the façade of the building has been retained. An additional entrance on the right hand side, symmetrical with the existing one, has been created. Residents of the new apartments will enjoy such luxuries as air-conditioning circulating 20 litres of air through the apartments every second, high-speed security gates to the basement car park operated by number plate recognition, and to the rear of the apartments the largest private garden to be created in London since World War II.

In the duplex apartments the mezzanine floor will be made of timber on Metsec purlins, so that it can be removed to create a stunning double-storey space.

An initial concept design in reinforced concrete had been developed when in early 2003 structural engineer Michael Barclay Partnership was consulted on the design. "We put forward a steel option because we thought going for wide-span construction would give the interior designers and architects a lot more freedom," says partner Tony Hayes. Adopting concrete would have meant using internal columns, or beams of a greater structural depth that would have carried a penalty of reducing the storey heights. "We came up with a steel alternative that removed four internal columns in every unit, and confined the structure to the line of the party walls," says Mr Hayes.

Universal columns along the party walls at around 2m centres support cellular beams spanning the full width of each apartment to create a column-free space. "Because the client is selling the apartments as shells we wanted to give them a blank canvas, so they wouldn't have to go back later and employ another engineer if they wanted to remove a column or modify the structure," says Mr Hayes. He adds: "The beauty of the scheme is that we can generate a service zone within the depth of the Fabsec beams."

Mr Hayes admits that the structure is not the most efficient solution by normal design criteria: "There's a lot of steelwork — it's not the most efficient solution in terms of the elegance of the structure. But it succeeds in terms of the flexibility it provides the end user to change the interior around."

Design of the cell beams, which was undertaken by steelwork contractor Bourne Steel, was complicated by a number of factors. One is the number of holes for services. "There are 300mm holes at 450mm centres, with a number of additional holes for ductwork over and above that," says Project Manager Rob Sperring of main contractor Multiplex.

Second, an unusually onerous deflection criterion applied. The deflection of the cellular beams under subsequent fitout loads, both imposed and dead, is limited to 1/750 of the span rather than the usual 1/360.

This is partly to protect expensive finishes such as marble floors which would be susceptible to damage, and partly because stiffer beams are less able to transmit vibration. The beams are pre-cambered to take out deflections under construction loads.

Preventing sound propagation was necessarily a key concern. The primary beams in each unit run from front to back of the building, one on each side of the main columns and supported by brackets. Blockwork party walls are built off these beams so that between each dwelling there are two walls separated by a void of around 700mm, which also acts as a vertical service duct.

Heavy acoustic damping pads were used in the steelwork connections

Above: most of the cladding to the rear elevation will be lifted in when the steel frame is complete. Below: a late design change to the roof was fitted into the programme.

Both the primary and secondary beams rest on Tico acoustic attenuation pads. In addition the fixing bolts are fitted with sleeves, collars and washers to prevent sound being transmitted through them. Vertical sound transmission is taken care of by the composite steel/concrete floor construction, with 150mm concrete on top of Richard Lees Holorib decking. Residents are thought likely to add over 100mm of their own finishes, probably with esilient material beneath. "Effectively there'll be 250mm of concrete on top of the beams," says Mr Hayes.

The construction timetable was tight. Demolition of the old structure and other buildings on the site began in January last year. Steelwork contractor Bourne Steel was appointed and integrated into the design phase from late summer 2003. Steelwork erection started on 16 December last year, after work on the basements had been completed.

"Everyone said we were crazy starting four days before Christmas," says Rob Sperring "but it highlighted a number of problems which Bourne worked on over Christmas. It gave us momentum so that when we came back in January we could hit the ground running."

Access was difficult because of the huge tubular bracing members supporting the retained façade, which crossed the site diagonally. Bourne Steel brought in two special Genie cherry pickers whose telescopic booms were fitted with "droop snoots" or articulated arms, giving them a reach of 25m.

"They could stand outside a bay and reach back to the far side of the bay next door," says Bourne Steel Divisional Manager Rod Potts.

Another advantage of the machines was that they allowed the steel to be fixed without the erectors having to walk on the steel itself at all.

The steel was installed bay by bay, with the cherry pickers standing on the garden area, erecting

A man with a vision

When Julian Simmonds retired from Citigroup, where he was an executive vice-president, after 29 years, he wanted to move into the ideal apartment.

"I was looking for a lateral flat," says Mr Simmonds, "something with 5–6,000sq ft of space without stairs, but I could never find anything suitable."

Discovering the Manresa Road site, he formed the idea of buying it and developing his own.

"The quality will be unprecedented in the residential sector," he says. "Buyers will be able to create big spaces. We've gone with steel because it gives the flexibility to form 60 x 40 ft rooms, and allowed people the freedom to do whatever they want."

Candy & Candy was brought in as project manager after he gained planning permission. Mr Simmonds pays tribute to the construction team: "I've been very happy with Multiplex and all the subcontractors. There's a good relationship between all of us. People like working on a prestigious site; we're spending the money we need to get a good job, being fair, and people have responded very fairly."

Mr Simmonds points to the flexibility of the structure and the ability to create huge rooms as factors which are attracting buyers. In addition there is a very high M&E specification, including full air-conditioning with humidification and air cleaning, and the choices for heating by warm air, underfloor, or radiators. An uninterruptible power supply will provide 48 hours' backup in the event of a power cut. And all the plant is designed to cope with the theoretical maximum number of people the apartments could hold, about 1500.

"It's not a problem that the apartments cost a lot of money," he says, "if you provide value for money."

Mr Simmonds intended Manresa Road to be a one-off, but does not rule out further property ventures if the right opportunity comes up.

Simmons: freedom and flexibility

the steel to its total height at the front and cascading back. This allowed following trades to get to work more quickly than constructing a level at a time over the building's complete width.

Installation of the steel is heading for completion this month, on schedule despite a design change to the roof steelwork. Angled rafters were introduced to form the profile of a mansard roof at penthouse level. "This transferred loads all over the place," says Potts. "The rafters were picked up by the gable beam, which needed a column to the second floor. Some of the beams that were already in fabrication had to be redesigned."

But between two and three weeks were recouped by changing the construction sequence, and the frame will be completed on programme or ahead.

This bears testament to what all concerned agree is a strong co-operative team spirit between everyone on site. "We have a good relationship with Multiplex," says Potts. "In site meetings we sit down and thrash out problems without animosity."

Multiplex's Rob Sperring says: "All the contractors are here because we want them to be. Bourne was selected because they've worked with us before and are recognised as a non-adversarial company who deliver."

The on-site atmosphere has been helped by the close personal attention given to it by Julian Simmonds, who is on site most days, and the feeling that everyone is working on something unique.

The first apartments are due to be handed over to their new owners in September, and the development is certain to become one of London's most prestigious addresses.

FACT FILE
21 Manresa Road
Developer: *Manresa Developments c/o Candy & Candy Ltd*
Main contractor: *Multiplex*
Architect: *Woods Bagot*
Structural engineer: *Michael Barclay Partnership*
Steelwork contractor: *Bourne Steel*
Steelwork tonnage: *1400t approx*
Steel decking: *9000m² approx*
Contract value: *Main contract value undisclosed*

A complex assembly operation

The brief for the roof of the Welsh Assembly building was simple: it should appear to float. Putting the vision into practice was more difficult

The roof consists of six shallow 'blisters' (top), one pierced by the debating chamber's 'funnel' structure (above and right)

FACT FILE
Welsh Assembly Building
Client: *National Assembly for Wales*
Design and build contractor: *Taylor Woodrow*
Architect: *Richard Rogers Partnership*
Structural engineer: *Arup*
Steelwork contractor: *SH Structures*
Contract value *£41M*
Steelwork tonnage *421t*

Dramatically sited on the edge of Cardiff Bay, the new Welsh Assembly building is nearing completion, with contractors working flat out to meet the handover date at the end of August. Unlike many prestigious projects, it looks set to be on time and on budget.

The building's most striking feature will be the complex steel roof. Supported on 12 slender columns and surrounded by a glazed public area, the roof is intended to appear as if it is floating in the air.

It consists of six shallow but elongated domes or blisters, one of which is pierced by the inverted funnel which rises majestically over the debating chamber.

Structural engineer Arup had the job of creating a lightweight structure. The roof was originally conceived as a flat plane but that would have meant a heavier form of construction. The shallow domes were adopted as a structural form with built-in rigidity.

Each dome's main structural members are two arched ribs canted over at 45° to the vertical. The horizontal thrust generated at the ends of the arch is resisted by ties running across each bay alongside the dome.

SH Structures fabricated and erected the steelwork. Estimating Manager Peter Redfern says fabricating the complex structure would have been extremely difficult without a 3D CAD model, which was created in X-Steel: "Not only is each bay curved, there is also a camber to take out live load deflections."

The most complex elements of the structure were the large nodes at the top of the CHS columns, fabricated from a combination of open, hollow and plated sections. This forms a transition to the circular hollow section members around the base of the dome. The arch members are also CHS sections, with purlins formed from channels.

The dramatic funnel structure over the debating chamber has curved universal beams as its main ribs, with circular hollow sections spanning between. "The only heavy sections are around the edge of each bay and at the top of the columns" says Mr Redfern.

The funnel is integrated into the main roof steelwork at the top, and drops down below roof level where its base is supported by a concrete ring beam. Above roof level it forms a tapered, glazed lantern topped by a 6m tall rotating wind cowl — the biggest of its type in Europe, inspired by the traditional oast house — which is part of the building's natural ventilation system.

In the final condition, permanent diagonal bracing members formed from high tensile bar run from the top of the columns, which are pinned at the base, to ground level.

Temporary stability during construction needed careful consideration — the structure was not inherently stable until it was complete. "There was quite a lot of temporary support needed, which we supplied using Tirfors and temporary bracing members," says Mr Redfern. "We carried out a trial erection of each bay at our works so we were confident it would go together as intended. That was a big help on site."

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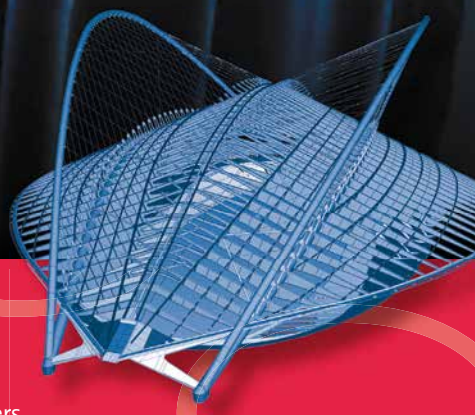

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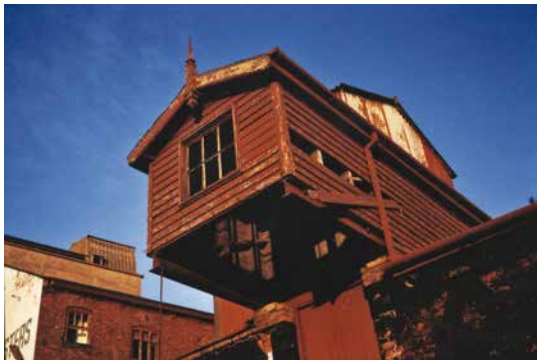


English Heritage has rescued the world's first metal framed building, but the challenge now is to find a new use for it

The historic forerunner of the multi-storey steel framed building has been saved for posterity after years of lying derelict.

After the failure of the latest development consortium to find a new use for Ditherington Flax Mill, in Shrewsbury, the building has been acquired by English Heritage.

When the mill was built in 1797 Shropshire was at the forefront of metal technology, Abraham Darby's Iron Bridge having been built across the Severn just 20 years earlier.

English Heritage historic buildings inspector for the West Midlands Region John Yates says: "It wasn't the first to use cast-iron beams or cast-iron columns, but it was the first use of beams and columns together in a three-dimensional metallic structure."

What Mr Yates describes as a "brilliant piece of work" was the brainchild of Charles Bage who formed one-third of the partnership that built the mill, Benyon, Bage and Marshall. Marshall was the flax mill king of Leeds, and Benyon was a successful local businessman who put up funding. Bage, a local surveyor, was the brains behind the design.

The driver for adopting a novel method of construction was fire resistance, at a time when this type of building normally had a high timber content.

The five-storey Ditherington Flax Mill uses cruciform cast-iron columns a single storey high. They widen slightly at mid-height but are very slender by today's standards at around 5in at their widest point. They are arranged in three rows, dividing the building into four bays of around 10ft wide.

Cast-iron beams span between the columns. They have an inverted Y-section with the space between the arms of the Y filled in; from the sloping sides of the beam a shallow jack-arched brick floor is built. Wrought-iron ties running at right angles to the beams resist the thrust from the arches.

The beams are bolted together rigidly off the line of the columns, and hence act as continuous rather than simply supported, producing a zone above the supports in which they are in tension. Cast-iron is, of course, not strong in tension: "There are a few fractures above columns due to overloading," says Mr Yates.

The beam/column connection employs a male/female joint which slots together and otherwise depends only on gravity to hold it together, with a pad of lead to account for casting irregularities.

The five storey buildings served for 100 years as a textile mill a further 90 as maltings

The innovative structure employs cruciform cast columns, inverted Y-section beams and wrought iron ties

Photo: John Yates

The columns are spaced at around 10ft centres in each direction and divide the building into four bays. The internal structure is not expressed at all on the outside of the building, which has loadbearing brick walls.

Little is known of the structure's creator, Bage. He is thought to have moved "in the same circles as Telford", though there is nothing to link him directly to contemporaries such as Abraham Darby, and he is not known for any other works.

His system of building was influential, though, and was widely copied especially in North West England. It was also adopted extensively throughout the next century for building railway underpasses.

"The idea you could do the whole thing in metal was further developed by others as wrought iron became more widely available in bigger sections," adds Mr Yates.

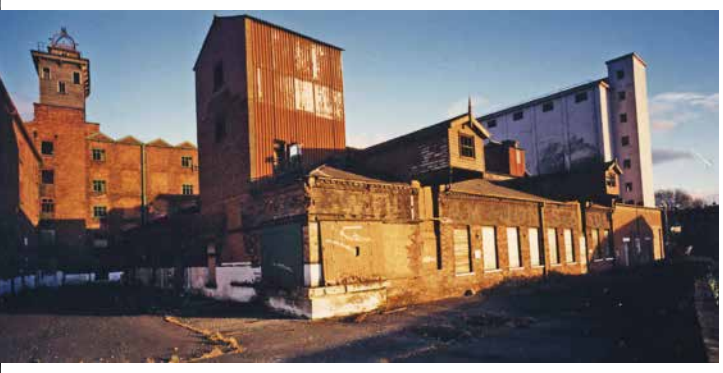
After serving for 100 years as a textile mill, and a further 90 as maltings, providing raw materials for the brewing industry, the mill has been disused since 1987 and had fallen into a poor state of repair. Successive developers have tried and failed to get schemes to turn it into offices, flats, retail units or a mixture off the ground.

"The mill was built very elegantly and economically compared with later structures, and the loadings it can take are less than might be expected," says Mr Yates.

Priorities now, says Mr Yates, are "a further round of emergency repairs, making it secure and accessible for people to see inside while its future use is established." There will be a new phase of a feasibility study to analyse options for a viaible use for the building.

"It's a particularly challenging building because of its lightweight construction," Mr Yates concludes. "It's a marvellous piece of construction but they were flying a bit close to the sun."

English Heritage has acquired the entire site, including two later iron framed structures and the hoist from the 1850s Dye House (top left)



The real vibration performance of modern steel-framed floors

The use of steel-concrete composite floor systems for multi-storey construction has increased dramatically over recent years. Dr Stephen Hicks, Building Engineering Manager at the Steel Construction Institute, analyses the vibration performance issues.

The recent increase in the use of steel-concrete composite floors is largely due to the response of the construction industry to clients' demands for buildings that are fast to construct, have large uninterrupted floor areas and are capable of accommodating a high degree of servicing. However, as a consequence of these developments, serviceability issues relating to the vibration response of the floor are sometimes becoming the governing design criteria because long slender spans can be readily achieved; the natural frequencies can be low; the construction is relatively light in weight; and the level of damping can be low. The recent highly publicised vibration serviceability problem with the Millennium Bridge in London has focused designers' attention on issues related to human acceptance of vibration.

Human perception of vibration

There are many possible ways in which the magnitude of the vibration response can be measured. However, due to the fact that instrumentation for measuring acceleration is normally more convenient, many modern standards describe the severity of human exposure to vibration in terms of acceleration. The perception of vibrations depends on the direction of incidence to the human body. To account for this, most modern standards use the 'basicentric' coordinate system shown in Figure 1 in which the z-axis corresponds to the direction of the human spine.

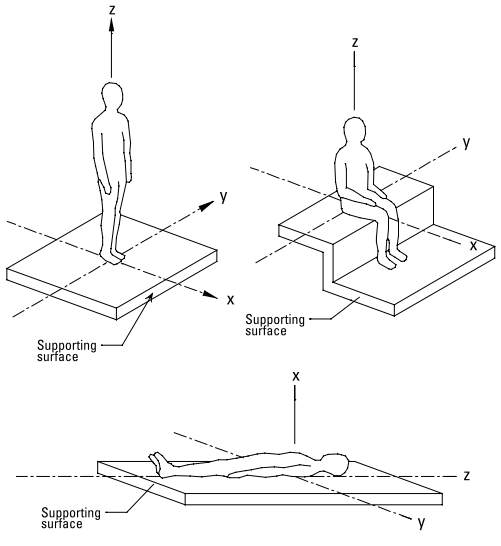


Figure 1: Directions of basicentric coordinate system for vibrations influencing humans

The standards BS 6472: 1992, ISO 2631-2: 1982 and ANSI S3.29 1983 are probably the most widely used codes of practice in modern design. These standards provide curves (known as 'base curves') that represent the variation of human perception with frequency for vibrations in x-, y- and z-axis. These base curves are plotted on graphs of root-mean-square (RMS) acceleration against frequency (see Figure 2). To enable these standards to cover many vibration environments in buildings, limits of satisfactory vibration magnitude are expressed in relation to the base curve by a series of multiplying factors that are applied to the RMS acceleration (also known as 'response factors'). The base curve for vibrations in the x-, y- and z-axis, together with a range of typical factored curves, is shown in Figure 2. Each line in Figure 2 represents a constant level of human reaction known as an isoperceptibility line: the area above a line corresponds to an unacceptable human reaction.

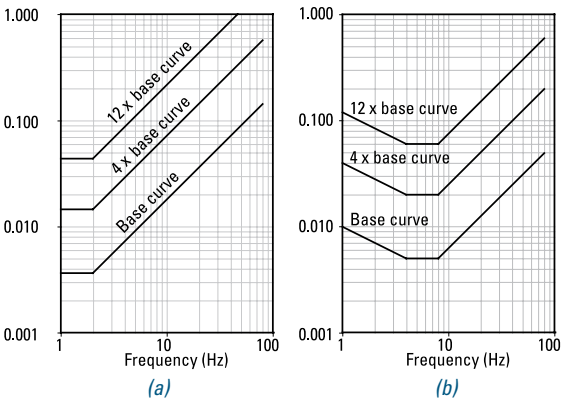


Figure 2: BS 6472: 1992, ISO 2631-2: 1982 and ANSI S3.29: 1983 building vibration curves for (a) x- and y-axis vibrations and (b) z-axis vibrations

BS6472: 1992 recommends that the response factors given in the second column of Table 1 should be applied to the base curve to provide a 'low probability of adverse comment' when continuous vibrations are considered. The NHS performance standard, Health Technical Memorandum 2045 (HTM2045), suggests that reponse factors for critical working areas, residential, office and industrial environments are appropriate for operating theatres, wards, general laboratories and workshops respectively. From experience of vibrations on particular floor types, additional reponse factors are recommended by SCI publication 076 and American Institute of Steel Construction/Canadian Institute of Steel Construction Design Guide 11; these are

given in the third and fourth column of Table 1 for comparison purposes.

Place	BS6472: 1992 (HTM 2045 similar)	SCI publication P076	AISC/CISC DG11
Critical working areas	1	—	—
Residential	2 to 4 (day-time) 1.4 (night-time)	—	7
Office	4	4	7
		8	
		12	
Industrial	8	—	—
Shopping malls	—	4	21

Table 1- Acceptable response factors as a function of the environment

Although the British Standards and Eurocodes require the designer to consider the effect of vibrations, they normally suggest that specialist literature should be considered for advice on the topic. For normal steel-framed floors, design guidance for vibration is provided in SCI publication 076, together with a series of accompanying Advisory Desk notes (AD253, AD254 and AD256). To supplement this guidance, SCI publication 331 has recently been produced for sensitive floors, such as those encountered in operating theatres within hospitals. For the special case of dance-floors, where the synchronised activities from crowds produce loads that should be considered at the ultimate limit state, BRE Digest 426 should be consulted.

Vibration tests on steel-concrete composite floors

Over the last seven years, vibration testing has been undertaken on a wide range of floor types. The reason for these tests has been to provide a better understanding of the vibration behaviour of steel-framed floors, and to demonstrate the conservatism that exists within the current design guides when compared to measurements from real floors. A selection of floors that have been subjected to vibration tests is shown in Table 2. This table presents the measured fundamental (first mode) frequency and the corresponding worst-case response factor from walking activities carried out on the test floors. The wide scatter of the natural frequencies reflects the range of structural types tested.

As can be seen from the table, all the floors tested easily satisfied the appropriate performance standards shown in Table 1 for office, laboratory and operating theatre environments (using the SCI parameters for the offices). In particular, for the three hospital floors that had operating theatre areas, it can be seen that the response factors were two to four times better than the HTM 2045 requirements. Since acceleration response is inversely proportional to mass, it would indicate that significant reductions to the slab thicknesses could have been made in these cases. The above table also shows the effect of increased levels of damping when different non-structural finishes are applied to the floor. For example, the highest response factor measured was for a floor where no finishes were present (the BRE test building, Cardington).

Project	Floor type	Finishes	Fundamental frequency (Hz)	Equivalent multiplying factor based on z-axis base curve
Test building BRE Cardington	9m span UB secondary beams spaced at 3m centres with 160mm deep composite slab	—	5.92	10.7
Paris Office Area 1	13.8m span cellular secondary beams spaced at 2.7m centres with 120mm deep composite slab	A	4.13	5.8
Paris Office Area 1	As above	C	4.19	2.6
Paris Office Area 2	15.7m span cellular secondary beams spaced at 2.7m centres with 120mm deep composite slab	A	4.44	6.3
Paris Office Area 2	As above	C	4.09	5.6
Paris Office Area 3	16.7m span cellular secondary beams spaced at 2.7m centres with 120mm deep composite slab	C	4.44	8.3
Cambridge Laboratory	6m span ASB's spaced at 6.6m centres with 296mm deep composite slab (Slimdek® floor)	A	11.38	3.9
SCI Headquarters	6m span UB secondary beams spaced at 2.5m centres with 130mm deep composite slab	E	8.35	4.1
Hospital 1 Operating Theatre	11.3m span cellular secondary beams spaced at 3.6m centres with 300mm deep composite slab	F	6.4	0.25
Hospital 2 Operating Theatre	15m span cellular secondary beams spaced at 2.5m centres with 175mm deep composite slab	F	7.6	0.49
Hospital 3 Operating Theatre	8.1m span UB secondary beams spaced at 2.7m centres with 140mm deep composite slab	F	8.0	0.21

Table 2 - Measured dynamic properties of 11 composite floors

Notes
A = Services,
C = False floor and services,
E = False floor, Services, Furniture, Partitions ,
F = Floor finishes, Services, Partitions

As reported in the November/December 2004 issue of New Steel Construction, through extensive back-analysis of measurements on real floors using finite element models the SCI has developed analysis software that is capable of providing much more accurate predictions of the floor response when subject to walking. The engineers of the Slimdek floor to the Diagnosis & Treatment Centre at St Richard's Hospital, Chichester have taken full advantage of this capability, which led to a 40% reduction in steel weight. As well as being applicable to other forms of structures, the analysis software has also been extended to predict the dynamic performance due to different loading types such as aerobic and crowd loads.

To date, the SCI has worked closely with a number of engineers to optimise their structures for vibrations at pre-construction stage and, on the rare occasion when floors have been found to be problematic in service, assessments have also been made on the completed structures. These structures have consisted of office floors, operating theatres, structures subjected to synchronized crowd loads and staircases.

New and Revised Codes and Standards

(from BSI Update March 2004)

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.

BS EN 1330:-
Non-destructive testing. Terminology
BS EN 1330-7:2005
Terms used in magnetic particle testing
Supersedes BS 3683-2:1985

BS EN 1994:-
Eurocode 4
BS EN 1994-1:-
Design of composite steel and concrete structures
BS EN 1994-1-1:2004
General rules and rules for buildings
Supersedes DD ENV 1994-1-1:1994

BS IMPLEMENTATIONS

BS ISO 20805:2005
Hot-rolled sheet steel in coils of higher yield strength with improved formability and heavy thickness for cold forming
No current standard is superseded

SPECIALIST BOOKS FROM BSI

BIP 2046:2005
Winning with health and safety for your business
No current standard is superseded

BIP 2047:2005
Winning with fire safety for your business
No current standard is superseded

UPDATED BRITISH STANDARDS

BS EN 10292:2000
Continuously hot-dip coated strip and sheet of steels with higher yield strength for cold forming. Technical delivery conditions
Including Amendments 1and 2

BRITISH STANDARDS PROPOSED FOR CONFIRMATION

BS 8100:-
Lattice towers and masts
BS 8100-2:1986
Guide to the background and use of Part 1 'Code of practice for loading'
BS 8100-3:1999
Code of practice for strength assessment of members of lattice towers and masts

BRITISH STANDARDS UNDER REVIEW

BS EN 10020:2000
Definition and classification of grades of steel

NEW WORK STARTED

BS EN 1993:-
Eurocode 3. Design of steel structures
BS EN 1993-3:-
Towers, masts and chimneys
NA to BS EN 1993-3-1
Towers and masts
NA to BS EN 1993-3-2
Chimneys

BS EN 1998:-
Eurocode 8. Design of structures for earthquake resistance
NA to BS EN 1998-1
General rules, seismic actions and rules for buildings
NA to BS EN 1998-2
Bridges
NA to BS EN 1998-4
Silos, tanks and pipelines
NA to BS EN 1998-5
Foundations, retaining structures and geotechnical aspects
NA to BS EN 1998-6
Towers, masts and chimneys

DRAFT BRITISH STANDARDS FOR PUBLIC COMMENT

05/30125587 DC
BS 5400-5 Steel, concrete and composite bridges. Part 5. Code of practice for design of composite bridges

05/30128028 DC
BS 4-1 Structural steel sections. Part 1. Specification for hot-rolled sections

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Fire in Boundary Conditions	**9 Jun 05**	**Birmingham**
Composite Design	**28 Jun 05**	**Dublin**
BS5950-1: 2000 - Understanding the Essential Principles	**6-7 July 05**	**Swindon**
Floor Vibrations - The problems identified and explained	**14 Jul 05**	**Darlington**
Introduction to BS6399 Pt 2	**7 Sep 05**	**Manchester**
Curved Steel - Angle Ring	**22 Sep 05**	**Tipton**

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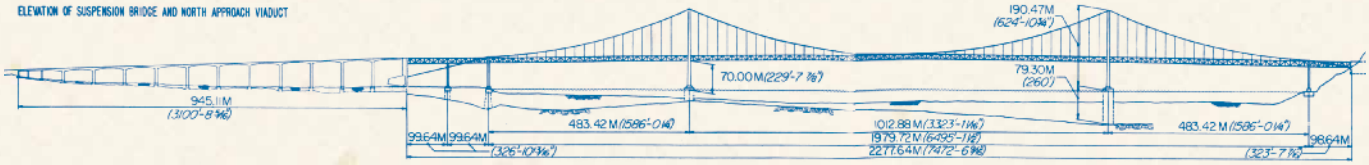


Bridge over the River Tagus

The £50 million suspension bridge at present being built across the Tagus River at Lisbon is reputed to be one of the most outstanding engineering and construction projects ever undertaken. The bridge will have the longest suspended span in Europe and the fourth longest in the world. It is also the longest bridge in the world designed for combined road and rail traffic and has the highest continuous trusses. It has the highest bridge towers in Europe and the world's deepest pier.

It consists of a 3,232 ft. centre span flanked by 1,586 ft. side spans, and has a clear height above water of 230 ft. The amount of steelwork used is in the region of 80,000 tons. It is expected that building the bridge and approaches will take 51 months, which means that the project should be finished early in 1967. The steelwork already nears completion and work on the approaches is well advanced.

Although at present only intended for road traffic, the bridge is so designed that if required a lower deck can be added with minimum effort to carry a double-track railway. This would involve the installation of a secondary cable system to take part of the additional live load without the necessity of altering the stiffening trusses. This combination road-rail design has been made practical by using for stiffening trusses considerable quantities of heat treated constructional alloy steel of 55-67 tons sq. in. of tensile strength.

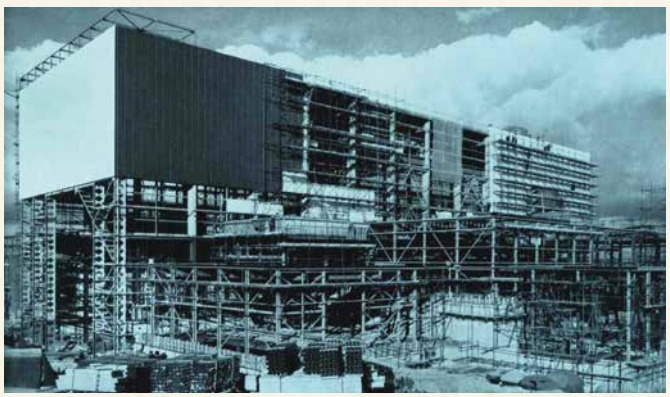
The main cables are massive: practically 2 ft. in diameter and constructed from 37 strands, each is made from 304 galvanised high strength steel wires of 0.192 in. diam. There are 11,248 wires in each cable, giving a total length of 33,676 miles of cable wire, an impressive figure.

S.G.H.W. prototype nuclear power station

An interesting project at present under construction at the U.K.A.E.A. Experimental Reactor Establishment, Winfrith Heath, Dorset, is a prototype steam generating heavy water moderated nuclear power reactor (S.G.H.W.) with an electrical output of 100Mw. This is a departure from the normal U.K. programme of nuclear power based on gas cooled graphite moderated reactors and fast reactors. Several large fast reactor power stations will probably be built from the middle of 1970 and onwards but, as the demand for nuclear power is increasing, it was considered desirable to study an alternative type of thermal reactor.

The decision to use a steel framework arose chiefly from the need to ensure maximum flexibility in design. The primary and secondary containment systems had not been evolved in detail at the outset of the project and the general plant layouts were unknown when the building was being designed. In addition, the use of steelwork permitted the maximum amount of fabrication to be done off site, this resulting in quicker erection of the framework and reduction of 'on-site' congestion of trades working within the confined space of the reactor area.

This model shows how the S.G.H.W. Nuclear Power Station complex will look when completed.



AD 287
Acoustic detailing: Steel columns in masonry separating walls

General guidance on acoustic detailing of steel-framed multi-storey residential buildings is provided in SCI publication P336 but no details are given for the integration of columns within masonry separating walls. The current issue of the Robust Details Handbook does not cover such details. This AD remedies the omission by providing typical details for solid and cavity masonry walls and demonstrates that satisfactory acoustic detailing of steel columns within separating walls can be achieved in multi-storey residential construction.

Background

Part E of Schedule 1 of The Building Regulation for England and Wales require that separating walls and separating floors in residential buildings "provide a reasonable resistance to the passage of sound". Approved Document E defines acoustic performance standards that are deemed to comply with the requirements of the Building Regulations. It explains that there are two methods of demonstrating compliance:

a) Carry out on-site tests to measure the acoustic performance of separating walls and floors, to confirm that the performance standards in Approved Document E are met.
b) Use Robust Details (RDs), as published in the Robust Details Handbook, throughout the building. Before construction the developer must also register the site with Robust Details Limited, who administer the RD scheme.

Steel columns in masonry separating walls

Robust Details of steel columns in masonry separating walls are not included in the Robust Details Handbook because there is currently insufficient evidence from on-site tests. In fact, in Appendix A of the Handbook there is a blanket statement that reads "steel columns built into masonry separating walls are not permitted". This statement has been taken out of context by some readers – it should not be taken as a prohibition but only as a statement that such a detail is not covered by any of the details in the current issue of the Handbook.

Although steel columns in masonry separating walls do not have RD status, this does not mean that steel columns in separating walls cannot be used to produce buildings that fully satisfy the requirements of Approved Document E and the Building Regulations. Viable details that can be expected to meet the performance standards are shown in Figures 1, 2, 3 and 4. These Figures show details for solid masonry walls and cavity walls. However, on-site testing would be required to demonstrate compliance with Approved Document E.

It is hoped that when there are sufficient results demonstrating satisfactory acoustic performance (at least 30 on-site tests are required by Robust Details Limited to obtain Robust Detail approval), details will be included in a future issue of the Handbook.

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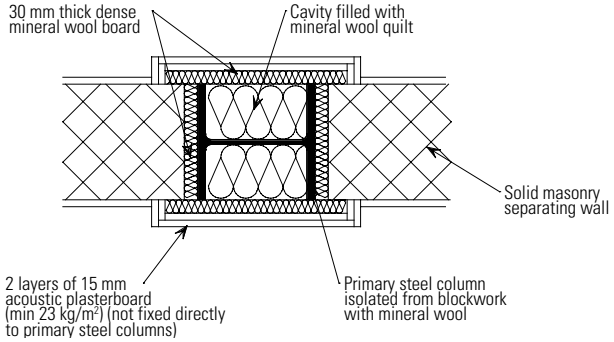

Figure 1: Steel column in solid masonry separating wall (based on detail in P322)

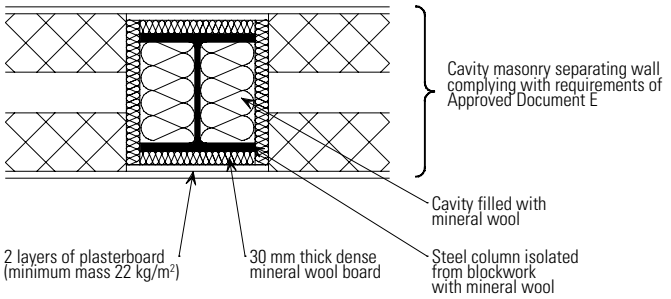

Figure 2: Steel column in cavity masonry separating wall

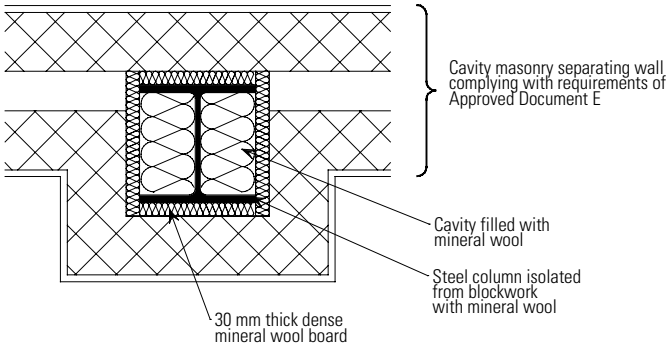

Figure 3: Steel column in cavity masonry separating wall (one leaf stepping round column)

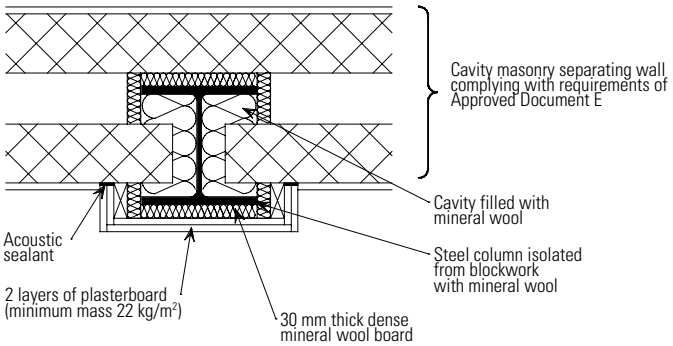

Figure 4: Steel column in cavity masonry separating wall (one leaf discontinuous because of column)

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SPECIAL OFFER

Portals Suite – Essential reading for portal frame designers

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Single-span steel portal frames are the most common form of construction for single storey buildings in the UK. In response to the questions raised by designers and steelwork contractors, the SCI has written two publications, one on design and the other on in plane stability of portal frames.

Design of single-span steel portal frames to BS 5950-1:2000 (P252)
P R Salter, A S Malik & C M King

This publication provides comprehensive information on the design of single-span steel portal frames. It also includes those aspects of design not properly covered by existing guidance.
It covers:

- A range of different types of steel portal frame.
- Design of single-span portal frames using hot rolled steel I sections.
- Preliminary sizing charts.
- Design for all the major components (columns, rafters, haunches, purlins, etc.)
- Clear advice on member checks.
- Worked examples based on BS 5950-1:2000 and comparison with software.

A4, 182 pp, 2004

In-plane stability of portal frames to BS 5950-1:2000 (P292)
C M King

This document introduces designers to the in-plane stability calculation methods in BS 5950 1:2000 for single-story portal frames designed using either elastic or plastic analysis. It covers:

- An introduction to the in-plane stability of single-storey portal frames.
- A commentary on the three methods of checking the in-plane stability of portal frames given in BS 5950-1:2000:
  – the sway check method
  – the amplified moment method
  – second order analysis.
- Worked examples on ordinary and tied portals.

A4, 224 pp, 2001

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Note: offer ends 31 July

The British Constructional Steelwork Association Ltd

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

BCSA is the national organisation for the construction industry; its member companies undertake the design, fabrication and erection for all forms of construction in building and civil engineering. Associate Members are those principal companies involved in the purchase, design or supply of components, materials, services etc, related to the industry. Corporate Members are clients, professional offices, educational establishments etc, which support the development of national specifications, health and safety, quality, fabrication and erection techniques, overall industry efficiency and good practice. The principal objectives of the association are to promote the use of structural steelwork; to assist specifiers and clients; to ensure that the capabilities and activities of the industry are widely understood; and to provide members with professional services in technical, commercial and quality assurance matters.

Details of BCSA Membership and services are available from: Gillian Mitchell MBE, Deputy Director General, British Constructural Steelwork Association Ltd, 4 Whitehall Court, Westminster, London SW1A 2ES. **Tel** 020 7839 8566 **Fax** 020 7976 1634

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 sub-categories contact Gillian Mitchell at the BCSA.

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The Register of Qualified Steelwork Contractors

BUILDINGS SCHEME

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

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

Company Name	Telephone	A	C	D	E	F	H	J	K	L	M	N	S	QA	Contract Value (1)
ACL Structures Ltd	01258 456051				●	●	●				●				Up to £2,000,000
Adstone Construction Ltd	01905 794561														In process of audit
Atlas Ward Structures Ltd	01944 710421	●	●	●	●	●	●	●	●	●	●			●	Up to £3,000,000*
B D Structures Ltd	01942 817770			●	●	●	●								Up to £1,400,000*
B & K Steelwork Fabrications Ltd	01773 853400		●		●	●	●	●	●		●			●	Up to £4,000,000*
A C Bacon Engineering Ltd	01953 850611				●	●	●								Up to £800,000
Ballykine Structural Engineers Ltd	028 9756 2560				●	●	●	●				●		●	Up to £2,000,000
Barrett Steel Buildings Ltd	01274 682281				●	●	●							●	Up to £6,000,000
Betgate Structures Ltd	01608 677551				●	●	●								Up to £100,000
Billington Structures Ltd	01226 340666	●	●	●	●	●	●	●	●	●	●	●		●	Up to £6,000,000
Bison Structures Ltd	01666 502792			●	●	●	●							●	Up to £2,000,000
Border Steelwork Structures Ltd	01228 548744		●		●	●	●	●				●			Up to £800,000
Bourne Steel Ltd	01202 746666	●	●	●	●	●	●	●	●	●	●	●		●	Up to £6,000,000
Briton Fabricators Ltd	0115 963 2901		●			●	●	●	●	●	●			●	Up to £800,000
CTS Ltd	01484 606416						●	●							Up to £800,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000*
Compass Engineering Ltd	01226 298388		●		●	●	●		●						Up to £2,000,000
Leonard Cooper Ltd	0113 270 5441		●			●	●		●		●			●	Up to £800,000
Curtis Engineering Ltd	01373 462126					●									Up to £400,000
Frank H Dale Ltd	01568 612212				●	●								●	Up to £4,000,000
Dew Construction Ltd (Fabrication Division)	0161 624 5631				●	●	●		●					●	Up to £800,000
EAGLE Structural Ltd	01507 450081				●	●	●	●		●					Up to £400,000
Elland Steel Structures Ltd	01422 380262		●	●	●	●	●		●			●		●	Up to £4,000,000
Emmett Fabrications Ltd	01274 597484				●	●	●								Up to £800,000
EvadX Ltd	01745 336413				●	●	●	●		●	●	●		●	Up to £1,400,000
Fairfield-Mabey Ltd	01291 623801	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000*
Fisher Engineering Ltd	028 6638 8521	●	●	●	●	●	●	●	●	●	●	●		●	Up to £6,000,000
Glentworth Fabrications Ltd	0118 977 2088					●	●	●	●	●	●	●		●	Up to £2,000,000
Graham Wood Structural Ltd	01903 755991	●	●	●	●	●	●	●	●	●	●	●			Up to £2,000,000
D A Green & Sons Ltd	01406 370585				●	●	●	●						●	Up to £3,000,000
William Hare Ltd	0161 609 0000	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456		●		●	●	●	●	●	●	●			●	Up to £6,000,000
James Bros (Hamworthy) Ltd	01202 673815				●	●	●	●				●		●	Up to £2,000,000
James Killelea & Co Ltd	01706 229411		●	●	●	●	●					●			Up to £6,000,000*
Meldan Fabrications Ltd	01652 632075		●		●	●	●	●	●		●			●	Up to £2,000,000
Mifflin Construction Ltd	01568 613311			●	●	●	●				●				Up to £2,000,000
Harold Newsome Ltd	0113 257 0156				●	●	●								Up to £1,400,000
Normanby Wefco Ltd	01724 875555		●						●		●			●	Up to £800,000
Oswestry Industrial Buildings Ltd	01691 661596				●	●	●		●		●				Up to £400,000
Quantrill Steel Ltd	01953 881853				●	●	●	●		●	●			●	Up to £40,000
RSL (South West) Ltd	01460 67373				●	●	●				●				Up to £800,000
John Reid & Sons (Strucsteel) Ltd	01202 483333	●	●	●	●	●	●	●	●	●	●	●			Up to £6,000,000
J Robertson & Co Ltd	01255 672855									●	●		●		Up to £100,000
Robinson Construction	01332 574711		●	●	●	●	●							●	Up to £6,000,000
Roll Formed Fabrications Ltd	028 7963 1631				●	●	●	●		●	●	●		●	Up to £800,000
Rowecord Engineering Ltd	01633 250511	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000
Rowen Structures Ltd	01623 558558	●	●	●	●	●	●	●	●	●	●	●			Up to £6,000,000
SIAC Butlers Steel Ltd	00 353 502 23305		●	●	●	●	●	●				●		●	Up to £6,000,000
Severfield-Reeve Structures Ltd	01845 577896	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000*
Henry Smith (Constructional Engineers) Ltd	01606 592121		●	●	●	●	●	●							Up to £2,000,000
Traditional Structures Ltd	01922 414172				●	●	●	●	●		●	●		●	Up to £800,000
Watson Steel Structures Ltd	01204 699999	●	●	●	●	●	●	●	●	●	●	●		●	Above £6,000,000*
Webcox Engineering Ltd	01249 813225				●	●	●				●				Up to £400,000
H Young Structures Ltd	01953 601881		●		●	●	●	●				●			Up to £800,000

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

RQSC
The Register of Qualified Steelwork Contractors Scheme

BRIDGEWORKS SCHEME

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

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

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

Company Name	Telephone	FG	PT	BA	CM	MB	RF	X	Contract Value (1)
Allerton Engineering Ltd	01609 774471	●	●	●	●	●	●		Up to £1,400,000*
Briton Fabricators Ltd	0115 963 2901	●	●	●			●		Up to £800,000
Butterley Ltd	01773 573573	●	●	●	●	●	●		Up to £3,000,000*
CTS Ltd	01484 606416	●	●		●	●			Up to £800,000
Cleveland Bridge UK Ltd	01325 381188	●	●	●	●	●	●		Above £6,000,000*
Coastground Ltd	01493 650455								in process of audit
Fairfield-Mabey Ltd	01291 623801	●	●	●	●	●	●		Above £6,000,000*
William Hare Ltd	0161 609 0000							●	Above £6,000,000
Harland & Wolff Heavy Industries Ltd	028 9045 8456	●	●	●	●		●		Up to £6,000,000
Interserve Project Services Ltd	0121 344 4888						●		Above £6,000,000
Interserve Project Services Ltd	020 8311 5500		●	●		●	●		Up to £400,000*
Mandall Engineering Ltd	0114 243 0001	●	●	●	●	●	●		Up to £800,000*
Meldan Fabrications Ltd	01652 632075	●	●	●	●	●	●		Up to £2,000,000
'N' Class Fabrication Ltd	01733 558989	●	●	●		●	●		Up to £1,400,000
Normanby Wefco Ltd	01724 875555	●	●	●			●		Up to £800,000
Nusteel Structures Ltd	01303 268112	●	●	●	●				Up to £2,000,000*
Rowecord Engineering Ltd	01633 250511	●	●	●	●	●	●		Above £6,000,000
Taylor & Sons Ltd	029 2034 4556	●	●	●	●	●	●		Up to £800,000
Watson Steel Structures Ltd	01204 699999	●	●	●	●	●	●		Above £6,000,000*

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

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- Information Technology
- Fire Engineering
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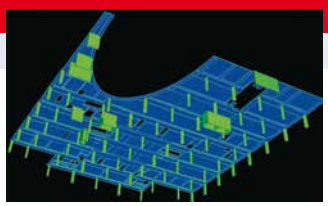

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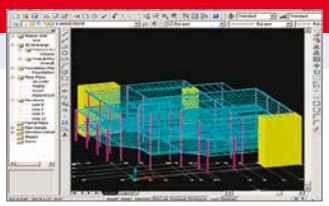

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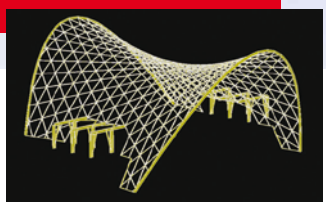

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