



IABSE NEWS

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International Association for Bridge and Structural Engineering

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I.K. Brunel (1806-1859)

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IABSE British Group News

Editorial

Welcome to *IABSE News*, the newsletter of the British Group of IABSE.

In recent months it has been hard to avoid the publicity in the engineering press and elsewhere surrounding the bicentenary of the birth of the Isambard Kingdom Brunel (1806-1859). This auspicious anniversary has prompted the production of books and radio and television programmes celebrating Brunel's life and achievements, and has prompted a number of academic and professional engineering bodies to organise conferences and meetings to celebrate *inter alia* how the spirit of Brunel is still alive in the engineering community of today.

I offer no apology for jumping on this 'band-wagon' by reproducing what is probably the most famous image of Brunel (standing in front of 'those chains') on the cover of *IABSE News*. Whether or not one agrees with the BBC television viewers who voted him into second place in the 'Greatest Briton' poll in 2002, one can not deny that I.K. Brunel was a larger-than-life character and an outstanding engineer. In particular, as an engineer he combined the vision required to conceive and plan projects on a large scale together with the attention to detail and determination needed to bring them to realisation. Brunel's portfolio of work included bridges, railways and ships, many of which represented the leading edge of technology at the time in their respective disciplines.

Today, engineers still maintain the heritage of Brunel through innovation in the design and construction of bridges, railways, ships and all other manner of engineering structures, machines and systems, but the context in which we undertake these activities today is profoundly different to Brunel's times. The fundamental difference is that the facts presented to us about the profound effects that human activity is having on planet Earth challenge us to live in a sustainable way, where what we do today takes into account the impacts of those actions on those who will come after us. Brunel was an early successor to the pioneers of the Industrial Revolution and in his times the effects of human activity on the environment of industrialised activity were still relatively small. However, the picture has changed as the environmental consequences of the vast urbanisation and industrialisation of the 19th and 20th centuries have become apparent through indicators such as global warming and dwindling natural resources.

This year, the IABSE British Group is promoting world class events which will address the challenges sustainability brings to bridge and structural engineers head on. Firstly, in July the annual Henderson Colloquium will focus on 'Factor 10 Engineering for Sustainable Cities'. Peter Head (Arup) will chair this event and a field of experts from a broad range of build environment disciplines will gather to promote and discuss how ten-fold improvements in energy and emission performance can be achieved in the cities of the future whilst maintaining and improving standards of living for all. Secondly, In December the IABSE Annual Lecture will be given by Bob Silman (Bob Silman Associates, New York) who is a world authority on sustainability in construction and who has served on IABSE Working Commission 7 on Sustainable Design.

As we celebrate Brunel's bicentenary in 2006 we will do well to mark his qualities of skill, vision and determination and reflect on how similar facets will be needed by engineers both now and in the years ahead in order to establish and maintain a sustainable future for our planet.

With best wishes.

Andrew Martin

The views and opinions expressed in *IABSE News* are those of the respective authors and not those of either the Executive Committee of the IABSE British Group or the Editor. Whereas effort has been made to ensure the accuracy of statements and acknowledgements, we reserve the right to be as wrong as everyone else.



IABSE Annual Lecture 2006

Bob Silman – ‘Sustainability’



On Thursday 7 December at 6.00pm, at the IStructE in London, **Bob Silman**, will deliver the 2006 IABSE Annual Lecture. His theme will be sustainability.

Please make a note in your diaries of this event, on a subject of ever-increasing importance to engineers and on which the speaker is a world expert, which promises to maintain the high standard of recent Annual Lectures. See *Events*, below, for further details.

Bob Silman is president of structural engineering firm Robert Silman Associates, which he has directed since its foundation in 1970 and which employs some 80 staff in New York and Washington DC. In addition to experience gained from a broad range of structural engineering activity he has expert knowledge of old and historic structures gained from many projects, ranging from the rehabilitation of tenement buildings in the Bronx, Manhattan and Brooklyn to work on the Carnegie Hall. He has also taught at Yale and Columbia Universities, at the Institute for Architecture and Urban Studies and at the Polytechnic Institute of New York.

Bob Silman is an international leader in the promotion of sustainable design and is chairman of IABSE Working Commission 7 on Sustainable Design. He has lectured and authored articles on sustainability, and has contributed to the *High Performance Guidelines for New York City Capital Construction Projects* sponsored by the Mayor’s Office of Construction (New York). Within his company he has led his staff in a comprehensive effort to revise their specifications and design methodologies to incorporate the principles of sustainability.

Professor David Nethercot OBE

I am sure that all members will join with me in congratulating David Nethercot, Charman of the IABSE British Group, on being awarded the OBE in the Queen’s Brithday Honours for services to Structural Engineering.

New Members

The following new members have recently joined IABSE and thereby also the British Group:

Katerina Fytopoulos
Andrew Green
John Lyle
Colin McKenna
Long Wang
Ian Wilson

A warm welcome is extended to all.



Events 2006-2007

<u>Date</u>	<u>Time</u>	<u>Event</u>
Saturday 17 June 2006		<u>Milne Medal 2006</u> Deadline for receipt of applications.
Monday 10 – Wednesday 12 July 2006	Residential	<u>IABSE Henderson Colloquium 2006</u> <i>'Factor 10 Engineering for Sustainable Cities'</i> Magdalene College, Cambridge
Thursday 26 October 2006 * <i>[Provisional – tbc]</i>	6.00pm	<u>Milne Medal 2005 – Lecture</u> David Tasker (Gifford, formerly of Capita Symonds) Milne Medal Winner 2005
Thursday 7 December 2006 **	5.00pm	<u>Annual General Meeting</u>
	6.00pm	<u>IABSE Annual Lecture 2006</u> <i>'Sustainability'</i> Bob Silman (Robert Silman Associates, New York)
	8.00pm (following Annual Lecture)	<u>Annual Dinner</u> (Fee payable. Prior booking essential.)
Thursday 15 March 2007 *	6.00pm	<u>Milne Medal 2006 – Lecture</u> Milne Medal Winner 2006

Note * - Provisional dates to be confirmed
 ** - Change of date from previous announcement

Venues Unless noted otherwise, all meetings and events take place at the Institution of Structural Engineers Headquarters, 11, Upper Belgrave Street, London. Tea is usually served before evening lectures and meetings from 5.30pm.

IABSE British Group Website

The website of the British Group can be accessed at www.iabse-uk.org, where proceedings of Henderson Colloquia and back editions of *IABSE News* are available in downloadable form. We are grateful to the Institution of Structural Engineers for their continued generosity in hosting the website.



Preview

Henderson Colloquium 2006: 'Factor 10 Engineering for Sustainable Cities'

The 2006 Henderson Colloquium will take place at Magdalene College, Cambridge, between 10 and 12 July. This year the theme of the colloquium is sustainability and is being chaired by **Peter Head** of Arup. On the purpose of the Colloquium, Peter writes:

“The majority of people on the planet will live in cities by 2050 and so the future of humankind is linked to how successful urban living will be as part of the planet’s eco-system. We know that our current model of urban development, created by the industrial revolution, is unsustainable because of environmental pollution and resource depletion. Decision makers and politicians in many countries have realised that we are at a tipping point in human history when the actions we take now will be critical to our survival. We need to find radical solutions and deep innovation in order to change direction.

Amory Lovins has inspired many engineers to look for ‘Factor 10 solutions’ in which performance outputs are improved by this order of magnitude. This colloquium is the first event to bring together ‘Factor 10 solutions’ which specifically address urban development performance – social, economic and environmental. The event is designed to enable leading thinkers, researchers and practitioners from all over the world to pool their ideas and see how they fit together. It is believed that a much more optimistic outcome can be realised by exploiting our current blindness to the virtuous cycles of sustainable development that successful competing organisms have mastered. Participation will enable contributors to place their ideas into an Eco-City resource model to explore a holistic approach to integrated urbanism that could lead to a new sustainable urban development paradigm based on clean-up and resource production. The model is one being developed for the Dongtan Eco-Demonstrator City in Shanghai and includes ecological footprint analysis.”

Following the usual pattern, participation in the Colloquium is by invitation and a strong group of delegates is being assembled, including representatives from the USA and from Germany. The proceedings of the Colloquium will be made available later this year in the IABSE British Group website (www.iabse-uk.org) and may also be published as a printed volume.

Executive Committee News

In recent months a number of changes to the composition of the Executive Committee of the British Group have taken place. Those who have stepped down from the committee, to whom thanks for their service are warmly offered, are:

Haig Gulvanessian Alan Pickett Mike Springett

New members welcomed to the committee, and whose affiliations are given in the Directory below, are:

David Brown Gerard Canisius Pal Chana Gerry Hayter Phil Williams

Structural Engineering International

The ongoing opportunity exists for all members to have articles published in *SEI*, the international journal of IABSE. Rules for publication are available through the IABSE website at www.iabse.org. David Doran is the UK Correspondent for *SEI* and can offer assistance to prospective authors (see Directory).



Report

IABSE Young Engineers Conference 2006: Design Values for the 21st Century

By Chris Woodfield, Buro Happold.

The third IABSE Young Engineers conference took place on 31 March. This year's event differed in format from the previous two conferences; being held over one day in London rather than two in Cambridge. This change was designed to improve access to students and young practicing engineers. The cost of the conference was covered by sponsorship from the IABSE British Group, The Happold Trust, Flint and Neill Partnership, The Highways Agency, Arup, Halcrow, Jacobs Babbie and Techniker.

A nominal attendance fee of £20 for young practicing engineers and £5 for students was collected and was to ensure delegates' attendance. However, the demand for places was overwhelming with the organisers having to turn people away. A grand total 120 delegates filled the Building Centre venue in central London to capacity, comprising 70 graduates and 50 student engineers.

The day was split in to three sessions, each focussing on a different topic and each concluding with an open floor discussion between delegates and the speakers.

The first topic was 'Sports Structures' where projects such as Wembley Stadium, the Emirates Stadium and several significant roller coasters were showcased. Issues discussed ranged from the requirements for design and crowd safety to the importance of the continuing interaction between engineers and architects during design. Speakers included Paul Westbury (Buro Happold), Rod Sheard (HOK Sport), John Roberts (Jacobs Babbie) and Mike Wade (Dorman Long Technology).

The second session was themed 'Construction Technology' and the topics mooted were timber structures, the design of wind turbine design, automated fabrication and advanced geometrical modelling of complex structural forms, and why architecture matters in bridge engineering. In this session the speakers included Jim Eyre (Wilkinson Eyre), Richard Harris and Paul Shephard (both Buro Happold) and Meagan Yates (Techniker).

The final session of the day concerned 'Sustainability' and how that extends in to civil and structural engineering. Peter Head (Arup) spoke about a fascinating project in China where a completely new sustainable city is being developed and designed. Angus Low (Arup) and Ian Firth (Flint and Neill Partnership) spoke about the recent trends in cycle and footbridges and their importance of fuelling urban regeneration and the increase in use of non- or low- carbon-emitting modes of transport in modern private and public developments.

The day's keynote speaker was Michael Dickson, President of the Institution of Structural Engineers, who spoke about design values for the 21st century and how it is the young engineers of today who must continue the massive advances that have been made in science, art and engineering that have enabled both aesthetically fantastic and socially and environmentally responsible projects to improve the built environment.

The day was a tremendous success with huge enthusiasm shown among the delegates at the possibilities and responsibilities they faces in their future careers. It is intended that the next IABSE Young Engineers conference will follow this year's successful format and be held on an annual basis.

[The conference was organised by a committee comprising young engineers Chris Woodfield and Dan Cash (Buro Happold) and Chris Walker (Flint & Neill Partnership), together with Ian Liddell and Ian Firth of the IABSE British Group. Our grateful thanks are due to all involved for organising what by all accounts was a first-rate event. Ed.]



Report

Young Researchers' Conference 2006

By *John Menzies and Gerard Canisius, IABSE British Group.*

There was a buzz and vibrancy in the air at 11 Upper Belgrave Street on Wednesday 15 March 2006 as the Young Researcher's conference got under way. Chaired by Michael Dickson, President of the IStructE, the Conference was attended by 52 young researchers and 25 other delegates. The IABSE British Group was represented by John Menzies and Gerard Canisius. Michael Dickson opened the Conference by thanking the sponsors of the event. After introducing the judges for the paper presentations and poster displays, he introduced the keynote speaker, Dr Steve Denton, Technical Director Bridges at Parsons Brinckerhoff, and invited him to address the audience.

Dr Denton spoke enthusiastically about structural engineering research and what he had learned from his own experiences. He described the value of research under five headings: Developing tools and tool makers; Fostering effective communication; Creativity and innovation; Leadership and judgement; and Fundamental understanding. His inspiring presentation was illustrated by examples and laced with well-chosen quotes – “Management is doing things right, leadership is doing the right thing” (Peter Drucker) and “If I have seen a little further it is by standing on the shoulders of giants” (Isaac Newton). He challenged the young researchers present to think ahead and recognise that the main contexts for the future work of structural engineers will be IT development, sustainability, globalisation and commoditisation, maturing infrastructure and Eurocodes.

Dr Denton questioned whether research is valued in the structural engineering profession and by employers. Regrettably the structural engineering research community is less active in communicating research when compared to, for example, biologists. He said that the industry's reluctance to pay a premium for a PhD is evidence of non-appreciation by employers of research and of a research background of employees. Echoing his earlier remarks he emphasised that research is valuable because it develops tool makers and effective communicators, stimulates creativity and innovation, develops leadership and judgement and an understanding of fundamentals. Research helps to understand questions and to communicate answers, a process that is much more difficult to do than finding answers to known questions. Dr Denton concluded his inspirational address by suggesting that young researchers should anticipate changing market demands, recognise change as opportunity, value their skills and bring influence and leadership to our profession.

Presentations by the authors of nine papers followed. After each presentation, the judges and audience asked questions giving the authors opportunity to amplify what they had said. The first prize was awarded to Daniel Walker of Oxford University who presented a paper on *'Interaction of extreme ocean waves with offshore structures'*. The second and third prizes were awarded, respectively, to James Norman of the University of Bristol who presented the paper *'Multiple support excitation of long span bridges'* and to Rachel Cruise of Imperial College, London, for her paper *'The influence of production routes on the behaviour of stainless steel structural members'*. The judges' criteria for assessing the papers were the significance of the research, the quality of the presentation and the methodology used.

There were thirteen poster presentations during a poster session after lunch. The posters were judged on the quality of the poster, contents of the research, understanding of the researchers of what they did, and the quality of their verbal presentation. The judges awarded the first prize to Florian Block of Sheffield University for his poster on *'The development of a component-based joint-element for endplate connections in fire'*. The second and third prizes were awarded, respectively, by Paul Jaquin of Durham University for *'Analysis of historic rammed earth structures'* and Robert Baldock of Cambridge University for *'Structural design optimisation for engineering practice'*.

All in all, this was a very lively and enjoyable event. The enthusiastic presentations by the young researchers, both formally and informally, were of a high quality and relevance. It was good to interact with these emerging talents and to be stimulated by them.



Review

The Milne Medal: The First Three Years

By *Graham Tilly, Hon. Secretary, IABSE British Group.*

In 2003 the British Group of IABSE launched an award for engineering excellence in structural design, named The Milne Medal, after Bob Milne the long serving secretary to the group. The intention of the award is to identify leaders in the profession and raise the profile of design engineers in general. The award is for an individual designer as opposed to a team and is open to Chartered members of British engineering institutions. It is awarded for submission of up to three projects designed in the last seven years.

2003 – Srinivasan

The first winner of the medal was ‘Srini’ Srinivasan, of Dar Consultants (UK), for his designs of Wadi Abdoun Bridge in Saudi Arabia and Wadi Leban Bridge in Jordan. He is a particularly worthy first winner as he is acknowledged as being one of the world’s leading designers of bridges and special structures, being responsible for the concept design and successful completion of many other prestigious projects which have been widely acclaimed for their combination of aesthetic grace and structural efficiency.

The Wadi Abdoun Bridge completed the final strategic link in the Amman Inner Ring Road and is a major landmark in the capital city. The four-span continuous cable-stayed structure glides across the Abdoun Valley on an ‘S’ curve having two main spans of 132m and a total length of 417m. As the project is located in a Grade 2 seismic zone, close to the Jordan Valley fault, the bridge was designed to withstand lateral pressures corresponding to a 1-in-120 year earthquake. The bridge comprises a dual two-lane prestressed concrete deck at a height of 45m at the central tower. The stays are composed of 15.7mm strands varying in number from 52 to 73 depending upon the cable length. Each tower arm consists of two identical parallel elements connected by a reinforced concrete web above and below deck. The towers have a constantly changing profile which diminishes in section over its full height. They vary in shape from a modified straight sided ellipse at the base to a circular section 26m above deck at the top. The upper arms are inclined to lie in the same plane as the cables and thereby eliminate avoidable bending moments and maximise equilibrium in the structure.

The Wadi Leban Bridge was a key element in the completion of the Riyadh Ring Road. It is the leading cable-stayed bridge of its type in the world for the size of deck carried on a single plane of cables. The bridge has a central span of 405m with side spans of 179m and is at an average height of 76m above the valley floor. The precast, prestressed, segmental deck consists of a trapezoidal spine having triangular side frames. The principal supporting piers are 72m and 80m in height to the underside of the deck. The towers have two solid inclined legs that merge 30m above deck to form a single solid section rising to 90m above deck level. The mirrored splay of the towers immediately above the deck with the piers immediately below gives rise to a striking vertical symmetry. The cable-stays support the deck at every other segment and are anchored at deck level. The cable strands are 15.7mm and vary in number from 16 strands and 87m length, to 52 strands and 420m length. All exposed inclined surfaces have textured finishes allowing uniform weathering and adding another dimension to the appearance.

2004 - Stephen Brown

The winner of the medal in 2004 was Stephen Brown of Buro Happold for his work on Millennium Point, Birmingham; St Catherine’s House, London and the QEII Great Court at The British Museum.

Millennium Point is a Landmark Millennium project composed of three buildings linked by a central atrium space. The layout is sufficiently flexible to enable the buildings to be adapted for different purposes in the future. As a conventional reinforced concrete slab on a 9m grid would have been too heavy it was necessary to develop a hybrid structure having structural steel beams and reinforced concrete. The bottom flanges of the beams were exposed to express the grid pattern in the slab soffit. The columns were also innovative being slender steel tubes of 457 mm diameter and filled with reinforced concrete. The design maximised the use of modular prefabricated components having bolted connections.



For St Catherine's House the historic masonry façade was not only retained but the inherent structural capabilities were utilized. The 90m long and 9 storey high structure was strengthened by casting reinforced concrete columns onto the faces of the internal steelwork to act compositely. A pile assisted raft was preferred to traditional bored piles for the foundations. The raft was 900mm thick and stiffened by mini-piles to provide sufficient strength to support the loads imposed by the requirement for 13m clear spans. An allowable floor depth of 550mm was achieved by casting the slab within the depth of steel beams spaced at 3m centres. Composite action was by shear reinforcement bars threaded through holes in the webs of the steel beams. Innovative columns were constructed as tubes within tubes having grout pumped in from the bottom of each lift. The external steel was painted to give an attractive appearance.

The Queen Elizabeth II Great Court is 92m by 73m, a little bigger than a football pitch, and contains the historic reading room. The project to enclose this area with a glazed roof had to be carried out without damage to the existing buildings. In order to safeguard the cast iron structure of the reading room vertical movements were not to exceed 10mm and differentials were to be less than 1:1000. It was necessary to have a basement that was 9.5m below the base slab of the Great Court and 5m below the existing foundations of the reading room. In order to meet these requirements safely the reading room was underpinned by jet grouting. It was also necessary to ensure that the roof imposed no significant horizontal loading to the buildings of the museum quadrangle and no additional load to the reading room. At its perimeter the roof was supported on short vertical posts at 6m intervals around the parapet. Support around the reading room was by 20 new columns. At the level of the reading room roof the columns were fixed to a new 2m wide horizontal concrete ring, the 'snow gallery', supported on sliding bearings and acting in compression to distribute the horizontal thrusts from opposing sides of the roof. Vertical loads were carried down the columns to the new foundations. The columns were composed of outer circular steel tubes of 457mm diameter and hollow inner 250mm square sections and filled with concrete. The roof was restrained laterally by X-bracing between the vertical posts at the periphery. The roof was composed of a fine lattice of rectangular members connected at nodes. The members were of hollow rectangular section 80mm wide to support the glass, 80mm deep at the reading room and 200mm deep at the periphery. Thicknesses of the flanges were from 10mm to 40mm and the webs were from 5mm to 10mm.

2005 - David Tasker

The winner of the Medal in 2005 is David Tasker of Capita Symonds for his design of The Hospital Footbridge, Stoke-on-Trent. The Hospital Footbridge is a 'gateway' structure across Newcastle Road, Stoke-on-Trent, and marks the entrance to North Stafford University Hospital. In consequence of a very limited budget simplicity was the essential hallmark of the design. The deck is 5.6m above road level, has an overall span of 34m and is 2.7m wide, and is supported at mid-span by a pinned arch spanning 26m between two piled concrete supports. Steel was selected for its ability to give slender and elegant structural forms, lightweight for site lifts and generally more economic for this scale of bridge. This advantage was maximised by designing the deck and arch sections as thin stress-skinned forms. The deck and arch were fabricated from 8mm and 10mm steel plate pre-curved to radius. Connections between the arch and strut were formed by stainless steel pins within stainless steel bushes to avoid bi-metallic corrosion. Thrusts from the arch and struts were resisted by the pile and pile cap. Lighting was by a purpose designed stainless steel deck unit using one source to light the deck, throw splashes of light onto the balustrades and provide a thin band of blue light when seen from the roadway, so that the bridge becomes a landmark at night as well as by day.

Reflection on the first three years

After the first three years it is timely to reflect on the Awards which have spanned a range of types and sizes of structure. At the one end of the scale Srinivasan's structures were large and elegant prestressed concrete highway bridges having total lengths of 480m and 820m, constructed in the Middle East. Stephen Brown's award was for three landmark buildings in city centres, constructed in concrete, masonry and steel, and incorporating original historic structures. At the other end of the scale David Tasker's structure was a 34m span footbridge designed in steel to the requirements that it be a landmark but not costing a premium over a conventional bridge; these are normally seen as being mutually incompatible specifications which are unusually difficult to match and rarely achieved at the same time. The awards have identified and publicised three designers who have fully met the requirements of their clients and produced elegant landmark structures in the great tradition of structural engineering.



Directory

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