

From research to reality

The 6th Young Researchers' Conference at HQ recently attracted a record number of participants. Kathy Stansfield reports

Sixty young researchers gathered for a day of discussion, presentation and networking held at IStructE recently, an annual event which has become an important date in the engineering calendar. As IStructE President Professor David Nethercot said, the event 'encourages people to come together, compete and network, making what could be lifelong contacts'.

Norman Haste, Chief Executive, Cross London Rail Links set the scene by reviewing some of the important ways in which research has advanced design on complex, large public construction projects with which he had been involved in the past 30 years.

He explained how the use of pre-stressed concrete on the dual 20ft flyover on Westway, the urban motorway in London on which he had worked, had been built using the span by span method. Then the longest elevated motorway in Europe, the spans were limited to 124ft and each pre-stressed unit was separated by an *in situ* joint. By the time he was involved in the Second Severn Crossing, advances in research and development meant that balanced cantilever construction allowed much faster construction with 144m spans. The cycle time was less than 2 weeks and match cast units were used with adhesively bonded joints.

Mr Haste showed how long span structures had developed, using as an example a hangar he had worked on at Heathrow with a clear span of 150m and 5m deep trusses where a screw jack system had been required to lift the very heavy steel sections. On the Terminal 5 project, currently under way at Heathrow, this expensive and relatively inefficient method had been replaced by

a 150m span wave form roof formed from an arch extended at each side with a vertical tie to reduce stresses. Welding technology and cutting advances had allowed the use of prefabricated girders to ensure economic construction. The use of thick-walled tubes and a torso demonstrated the high tolerances achievable in design.

The problems of aerodynamics suffered by the Tacoma Narrows bridge had been overcome by advances in the understanding and testing of wind behaviour allowing longer, taller structures to be designed efficiently, incorporating dampers.

His work on the Humber Bridge, in the late 1970s the longest suspended span in the world at 1410ft, benefited from advances in box girder bridge design by using orthotropic box girders. These were very strong and capable of being designed into very efficient shapes – an advance repeated many times since.

He reminded those present that universal computer use was a relatively

Right: Norman Haste, Chief Executive, Cross London Rail Links



Below: Detail of T5 roof
Bottom: Cross Rail tunnels will use sprayed concrete linings, allowing tunnel cross sections to be varied



recent phenomenon in the design office. One of the benefits in the past decade had been in the ability to analyse structures with a lot of redundancy in them, making longer span bridges possible. He cited the spectacular Pont du Normandie bridge in France with its 812m central span as a case in point.

His latest work on Cross Rail involves the use of sprayed concrete linings in station tunnel design. This has been made possible as result of a lot of research into cement and concrete additives for workability and very early strength. It allows different shapes from the traditional circular cross section to be used, and the intersections between passages and shafts to be completed more quickly.

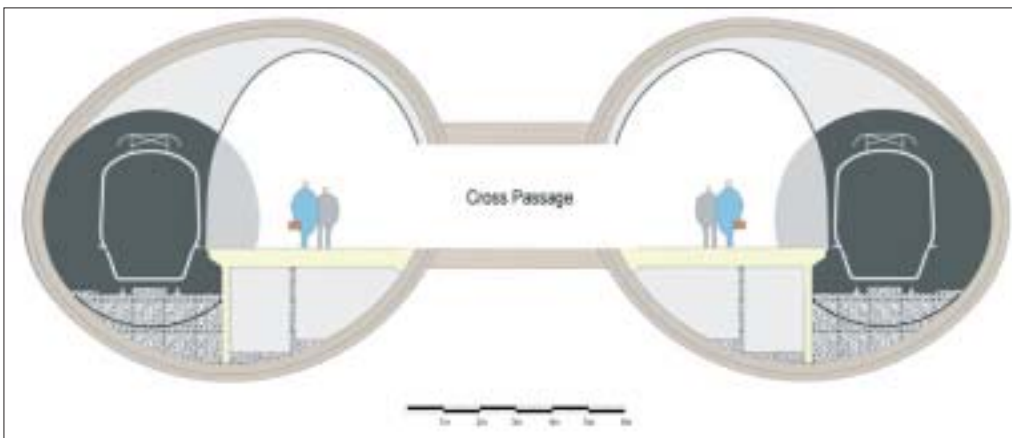
He concluded by demonstrating how structural engineering interacts with nature by showing a video clip of the effect of ice packing on Prince Edward Island bridge across the Northumberland Straits in Canada. This 12.9km bridge, with only a single lane in each direction, was built because of the high cost of keeping the waterways open in winter. Its precast units were erected as balanced cantilevers in the summer months. His film showed how the torus at water level overcame the pressure of 2ft thick packed ice, cracking it as it began to break up.

Mr Haste emphasised the importance of small advances in research which accrue to make new developments possible. Those present were urged to see their work in this context. He emphasised how much practitioners such as himself appreciated the work of researchers which helped them to deliver ever more efficient major structures.

The sponsors of the 2004 conference are IABSE (British Group); EPSRC; ICE; Buro Happold, Arup, and Flint & Neill Partnership.

Judges comments

The presentations were assessed by members of the Research Panel and invited judges. The assessments were



Young Researchers' Conference 2004 winning projects

Poster category

- 1st prize (£300)
Behaviour of composite joints including panel zone deformations (José Castro, Imperial College)
- Joint 2nd prize (£225)
The flexural strength and ductility of concrete sections with inadequately anchored reinforcement (John Lau, Birmingham University)
- Joint 2nd (£225)
The effect of bone graft bed depth on the short term stability of revision hip arthroplasty: a finite element investigation (Andrew Phillips, Edinburgh University)

Oral Category

- 1st prize (£350)
Developing a design rationale for traditional pegged connections in green oak carpentry (Jonathan Shanks, Bath University)
- 2nd prize (£200)
Probabilistic analysis of highway bridge loading events (Colin Caprani, University College Dublin)
- Joint 3rd prize (£100)
Investigating the causes of silo honking during discharge (Jesus Chavez-Sagarnaga, Edinburgh University)
- Joint 3rd prize (£100)
Numerical modelling of building structure response to tunnelling (John Pickhaver, Oxford University)

Shortlisted projects

- Wind loading pressure coefficients on a conic shaped fabric roof: experimental and computational methods (Jennifer Burton, Newcastle upon Tyne University/BRE)
- New forms of cable domes and their stability (Sana El-lishani, Surrey University)
- Structural vulnerability theory (Juan England, Bristol University)
- Lightweight PFRP structures (Mark Evernden, Warwick University)
- Impact of fire on the structure of WTC 1&2 using finite element analysis (Graeme Flint, Edinburgh University)
- Optimising timber frame construction (Robert Hairstans, Napier University/Oregon Timber Frame)
- The effects of crowds on dynamic characteristics of stadia structures (Zainah Ibrahim, Sheffield University)
- The fundamental behaviour of tension zones (Kok Loon Kong, Leeds University)
- Robustness of steel framed building (Ru Liu, Sheffield University)
- Analysis of reduced modulus action in U-section steel sheet piling (Richard Mawer, Southampton University)
- Structural integrity of steel connections (Enrique Munoz-Garcia, Sheffield University)
- The behaviour of perforated cold-formed thin-walled steel studs in fire (Bashar Salhab, Manchester University)
- Compressive membrane action in reinforced concrete slabs (Ahmed Shaat, Queen's University Belfast)
- Asymmetric tuned liquid column dampers (Michael Smith, Dundee University)
- Foldable composite tube hinges (Jeffrey Yee, Cambridge University)
- Application of catenary action used in steel beams under fire conditions (Yingzhi Yin, Manchester University)



Above: Award winners (from left) Colin Caprani, IStructE President Prof. David Nethercot, José Castro, John Lau, Andrew Phillips, Jonathan Shanks, John Pickhaver and Jesus Chavez-Sagarnaga

made on the quality of the presentations themselves and not on the quality or specific relevance of the research that had been carried out to date. Separate judging was conducted of the oral and poster presentations.

David MacKenzie, chairman of the Research Panel and oral judges said: "The judges agreed that the standard of the oral presentations remained high and in some cases exceeded that expected of more senior researchers presenting in international conferences. The standard has been increasing each year, making the conference highly informative and well worth attending. Judging was complicated by the diversity of subjects covered, but a clear winner emerged in Jonathan Shanks whose competent and structured use of theoretical methods and practical experimentation were clearly evident. His considerable interest in his research work is also to be commended. Additional prizes were awarded to Colin Caprani, Jesus Chavez-Sagarnaga and John Pickhaver, each of whom showed a strong grasp of their research material and gave polished presentations that were highly informative."

Duncan Lillistone, chairman of the poster judges said: "The judges for the poster sessions were also impressed by the quality all of the young researchers' presentations which made judging all

the more difficult. The main criteria used by the judges were the presentation and linkage between text and pictures in the posters as well as the young researcher's understanding of their work when questioned. Apart from the prize winners, the judges acknowledged Jeffrey Yee (Cambridge University), Sana El-lishani (University of Surrey) and Graeme Flint (Edinburgh University) as having particularly outstanding visual presentations". The prizes were presented by IStructE President, Professor David Nethercot.

The synopses of all the projects presented orally or as a poster can be found on the webpage for the Young Researchers Conference: (www.istructe.org.uk/technical/index.asp?page=35).

Coming full circle: Duncan Lillistone (M) was one of the judges: 5 years ago he was a participant

Lunchtime networking

