

## Polish event debates design and dynamics of footbridges

How to build attractive footbridges at a reasonable cost was the central theme of the recent *Footbridge 2011* conference in Wrocław, Poland. In common with previous footbridge conferences, however, the lively debate between delegates and speakers challenged the theme and attempted to open the subject much wider during the course of the three-day gathering.

The conference, which was organised and hosted by the Wrocław University of Technology, drew almost 300 engineers, architects, bridge owners and specialist suppliers to the Polish city at the beginning of July.

Keynote speaker Brian Duguid argued the case for footbridge owners and designers – in particular those producing ‘landmark’ structures – to more thoroughly review the out-turn costs of such bridges. He suggested that the industry should also make more effort to assess the value of these bridges, particularly in terms of less tangible benefits such as regeneration. The cost of a structure could more helpfully be assessed in relation to its value, Duguid said, and a footbridge that was expensive to build might nonetheless be considered worth the cost if its value was significant (see page 28).

Architect Cezary Bednarski, meanwhile, suggested that another way of looking at the debate would be to demand reasonable structures at an attractive cost. He was scathing about the appearance of a number of recent footbridge projects and suggested that it was up to designers to impose their own ‘chains’ – whether they be financial, structural or aesthetic – in order to ensure that they did not end up creating irrational structures that were wasteful and over-designed.

Jan Biliszczuk gave delegates a visual tour of the historical and present-day bridges of Poland, ranging from the country’s first reinforced concrete footbridge which was built in Lwów in 1894, the first use of glued timber beams in 1975 and plastic beams in 2002, up to the present-day trend of landmark footbridges which are being built throughout the country.

Cable-supported bridges are now very popular as a structural form for Polish footbridges, Biliszczuk explained, with the recently-completed crossing of the San River in Witryłów achieving a span of 150m at a cost of just US\$3,464 per square metre. Poland also boasts what is claimed to be the longest-span cable-supported glued-timber deck footbridge at Sromowce Niżne, at 90m.

In common with the previous footbridge conferences there were specialist sessions focussing on dynamics, with presentations addressing live loading considerations, ongoing research, and state of the art technology intended to aid



The conference was held in Wrocław, a city of many bridges including Grunwaldski Bridge which has flat plate ‘cables’

designers in managing lively structures. Whereas previously the industry has focussed efforts on designing bridges that do not suffer dynamic excitation, the current thinking is much more a case of using active damping equipment, or accepting that under certain load cases, structures may be lively. In part this may be a case of educating bridge owners by making them aware of the likelihood of excitation and the conditions that may provoke it, and giving them the choice of managing such conditions, or eliminating them altogether with dampers or structural adaptations.

Alexander Pavic from the University of Sheffield in the UK gave a keynote presentation focussing on a review of design guidelines and their application, particularly in relation to excitation from a stream of pedestrians. Existing design procedures proposed by Eurocode 5, ISO 10137, the French Setra guideline, the UK national annex to Eurocode 1 and HIVOS were discussed, and then applied to a simple case study.

Pavic’s investigations found a significant variation between the acceleration responses calculated by these different codes, using dynamic loading from a group of walkers crossing the bridge in a density of 0.5 pedestrians per square metre. Results could differ by a factor of approximately four, he found, despite the fact that they nominally model an identical loading situation. The responses calculated by EC5 were likely to be considerably over-estimated, Pavic noted, and suggested that this guideline should not be used if accurate results were required. The UK national annex provided the lowest and most believable results, and was the most versatile in terms of considering other load cases, Pavic added.

He also reminded delegates of the fact that the location and proposed use of each footbridge should be central to considerations about dynamic vibrations. What might be acceptable for a little-used footbridge on a walking trail would not necessarily suit a more heavily-used structure which gave access to a hospital, for example.

The conference also provided an excellent opportunity for bridge designers to find out about some of the many unusual footbridges that have been built around the world during the last few years, with delegates travelling from as far away as Australia, Guatemala, Columbia and South Korea, as well as North America and many European countries to attend and present papers.

Some recent examples show innovative use of materials such as weathering steel, timber, and even prestressed granite, and yet there were still plenty of footbridges that employed traditional materials in unusual and exciting ways. Hybrids of steel and glass-fibre reinforced polymers; integrated steel and timber footbridges; and various composites and laminated combinations were all present, offering food for thought to the engineering delegates looking for inspiration. New computer-controlled technologies for steel fabrication and composites production are also offering exciting possibilities for future designs, with a number of the presented projects showing how these could be used imaginatively to create sculptural footbridges.

The conference concluded with an announcement that *Footbridges 2014* will be held in London, UK.

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