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Editorial: A time of uncertainty and fragility

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Welcome to the second part of our themed issue dealing with the theme of changing climate. We are reminded of the fragility of our man-made systems even to current environmental pressures by the transport chaos created from the eruption of the Eyjafjallajökull volcano in Iceland. I wrote this editorial while stranded in San Francisco, unable to return to the UK as all flights had been cancelled. I was also away from the canvassing and political turmoil in the UK in the run-up to the May 2010 general election. I was fortunate compared with many others stranded as I was in a pleasant place and had hotel access. The disruption to flights showed how dependent we in Europe have become on this form of transport for goods and personal travel. This was an acute shock to our systems rather than the chronic effects we expect from climate change, yet in the history of the planet both types of impact are over very short timescales.

The vulnerability of our core infrastructure systems to both types of shock is apparent and are a result of design and planning systems that are based on 'optimisation' of their performance – leaving little headroom when perturbations occur. Recent concepts such as 'just-in-time' provision leave no space for coping with uncertainty and need to be re-appraised in light of this (Hallegatte, 2009). Concepts such as flexibility, reversibility and adaptability need to be reconsidered in the design and operation of our infrastructure systems. In the USA not only was there no interest in the UK's general election, but scant information about the flight chaos in Europe. This should be contrasted with the UK media's over-interest in all things American. It is not surprising therefore that many in the USA have no awareness of or belief in climate change. I was informed by someone on the boat back from Alcatraz that climate change was actually a conspiracy of the American Government used only as a reason to curtail the individual freedom of citizens.

This issue of *Engineering Sustainability* has four papers and four briefings, as well as a historical paper featuring a re-publication of Schumacher's seminal work *Small is beautiful* (Jeffrey, 2010). The other briefings include topical information on carbon critical design (Clarke, 2010); Engineering Council guidance on Sustainability (Bogle, 2010); new geogrid technology for ground stabilisation (Dixon and Hall, 2010); and green IT Infrastructure (Sudworth, 2010). The papers cover: how low-carbon housing design is being informed by research (Gillott *et al.*, 2010); how bridges may be delivered sustainably to help tackle climate change (Zhang, 2010); how climate change impacts on-demand

irrigation systems (Daccache and Lamaddalena, 2010); and the place of appropriate drainage systems for tackling a changing climate (Faram *et al.*, 2010).

Whilst in the USA I attended the ASCE low impact development (LID) conference, dealing primarily with stormwater systems. Unlike the UK, and in common with Australia and New Zealand, American practice adopts a 'can-do' approach. There are known problems with non-piped drainage systems and the Americans have moved on from the best management practice (BMP) approach of the past, where ponds were seen as acceptable at the ends of pipes, in the way that many SUDS systems are applied in the UK, to LIDs: a holistic catchment and urban planning approach involving partnerships in municipality-led development and retrofits. Much of this is now being badged as green infrastructure (GI). Significant efforts are now being made to evaluate in financial terms the added-value of LID or GI as an alternative or complement to traditional piped system drainage (Wise *et al.*, 2010) also identified in this issue by Faram *et al.*, (2010).

Wise *et al.*, (2010) identify the value of urban forests in: stormwater retention; reducing demand for energy for cooling and heating; reducing negative health impacts from extreme heat events; air quality improvements; and carbon dioxide reductions (avoided and sequestered). Permeable pavements and permeable road surfaces are now becoming standard practice in much of the USA in retrofits as well as new-build areas. These contribute by: increasing stormwater retention; reducing energy use, air pollution and greenhouse gas emissions; reducing ground conductivity (also reducing the need for de-icing agents); reducing air pollution; and reducing noise pollution. Rainwater harvesting for non-potable use also provides: reductions in potable water use; increased water storage; improved plant life; and enhanced public engagement and education. Other measures detailed include green roofs and infiltration practices. Each of these has been considered in terms of the added-value benefits above and also to, for example, reduce crime rates in GI neighbourhoods. The Center for Neighborhood Technology has developed a green values calculator that will be finalised together with a handbook in summer 2010, which uses Life Cycle and other analysis tools to estimate the monetary values of these other benefits. An early version of the tool is available at www.cnt.org/natural-resources.

In one study for the City of Philadelphia, it was shown that the added-value of using GI to retrofit for combined sewer overflow reduction resulted in additional societal benefits of some \$2bn compared with an added value of using conventional sewerage storage tunnels of only \$122M. This does pose the question, however, of whether or not the providers of stormwater systems should be responsible for delivering such significant societal added benefits. As it is the municipalities responsible for both in the USA; this is not a question of relevance, unlike England and Wales, where the private water companies have only limited duties to society at large.

The lesson I am trying to make here is that if we are to effectively tackle climate and other perturbing events in the future, a more holistic, inclusive and joined up multi-value approach will be required for our infrastructure and services. In the UK the multiplicity of agencies, institutions, service deliverers and the drive for efficiency over resilience makes the future rather frightening. We will experience more events like the recent volcanic eruption over both short-term and long-term timescales; therefore as professionals we need to find ways of making the impacts from these much less unpleasant than I and many others experienced in April 2010.

REFERENCES

- Bogle D (2010) Briefing: UK's Engineering Council guidance on sustainability. *Proceedings of the Institution of Civil Engineers, Engineering Sustainability* 163(2): 67–69, doi: 10.1680/ensu.2010.163.2.67.
- Clarke B (2010) Briefing: carbon critical design. *Proceedings of the Institution of Civil Engineers, Engineering Sustainability* 163(2): 63–65, doi: 10.1680/ensu.2010.163.2.63.
- Daccache A and Lamaddalena N (2010) Climate change impacts on pressurised irrigation systems. *Proceedings of the Institution of Civil Engineers, Engineering Sustainability* 163(2): 97–105, doi: 10.1680/ensu.2010.163.2.97.
- Dixon JH and Hall C (2010) Briefing: New geogrid technology for ground stabilisation. *Proceedings of the Institution of Civil Engineers, Engineering Sustainability* 163(2): 71–73, doi: 10.1680/ensu.2010.163.2.71.
- Faram MG, Ashley RM, Chatfield PR and Andoh RYG (2010) Appropriate drainage systems for a changing climate. *Proceedings of the Institution of Civil Engineers, Engineering Sustainability* 163(2): 107–116, doi: 10.1680/ensu.2010.163.2.107.
- Gillott M, Rodrigues L and Spataru C (2010) Low-carbon housing design informed by research. *Proceedings of the Institution of Civil Engineers, Engineering Sustainability* 163(2): 77–87, doi: 10.1680/ensu.2010.163.2.77.
- Hallegatte S (2009) Strategies to adapt to an uncertain climate change. *Global Environmental Change* 19(2): 240–247, doi: 10.1016/j.gloenchava.200.12.003.
- Jeffrey P (2010) Historical paper: E. F. Schumacher's *Small is Beautiful*. *Proceedings of the Institution of Civil Engineers, Engineering Sustainability* 163(2): 57–62, doi: 10.1680/ensu.2010.163.2.57.
- Sudworth T (2010) Briefing: Green IT infrastructure. *Proceedings of the Institution of Civil Engineers, Engineering Sustainability* 163(2): 75–76, doi: 10.1680/ensu.2010.163.2.75.
- Wise S, Braden J, Ghalayini D *et al.*, (2010) Integrating valuation methods to recognize green infrastructure's multiple benefits. *Low Impact Development 2010: Redefining Water in the City, San Francisco*, pp. 1123–1143.
- Zhang C (2010) Delivering sustainable bridges to help tackle climate change. *Proceedings of the Institution of Civil Engineers, Engineering Sustainability* 163(2): 89–95, doi: 10.1680/ensu.2010.163.2.89.