Editorial

Costas Georgopoulos CEng, FIStructE, FEA, FHEA, FICE
Honorary Professor, Brunel University, UK; Principal Lecturer, Kingston
University, UK; and Chairman, Editorial Advisory Panel

I would like to start this editorial, being the first in 2013, by thanking the members of the editorial advisory panel, the paper reviewers and the publisher for their contribution to the journal's success in achieving an excellent international reputation. In the first 2 years of its life, *Forensic Engineering* published over 30 papers on professional practice and original research in forensic engineering, including a themed issue on education, and developed a healthy waiting list of promising authors and potential papers. The journal homepage www.forensicengineeringjournal.com received approximately 2000 visitors per month, peaking to 8000 in February 2011, and 5000 in May 2012. Let's all keep up the good work.

This issue contains one briefing and four papers with a wealth of 'lessons learned' that underpin forensic engineering practice. Topics covered include concrete structures affected by cracking, forensic engineering education reform, failure investigation of a drilled shaft stabilised slope, investigation of large-scale building envelope leakage and impact of heavy snow accumulation on roof serviceability.

With most of the world's critically ageing infrastructure being made of concrete there is a legitimate concern about concrete serviceability failure although this is largely associated only with cracking. In a useful briefing (Ingham and McKibbins, 2013), typical types of concrete cracking, potential causes and possible consequences are examined together with case studies demonstrating where cracks usually occur in practice.

Despite an active promotion during the 1990s and 2000s, forensic engineering education in the USA remains bleak. The current practice of failure investigation studies in engineering degrees only introduces students to the profession and does not provide them with sufficient depth in the art and science of forensics. Taking into account the fact that the USA leads the world on the subject, this paper presents a robust rationale for establishing forensic engineering as a discipline at universities and developing full-scale undergraduate and postgraduate courses (Chen and Janardhanam, 2013). Standard engineering disciplines do not satisfy important learning outcomes of a forensic engineering degree such as an understanding of the complex relationship between engineering and the legal profession or the ability to conduct a forensic investigation. A broad forensic engineering curriculum would include subjects such as systems engineering, inverse problem-solving, failure analysis

techniques and specialised research methodology that establishes causality through quantitative and qualitative experimentation. It is also proposed that both research and apprenticeship should be part of the curriculum, in contrast to conventional wisdom in forensic engineering education. With increasing market demand for forensic engineering practitioners, the need for a taught discipline at universities is pressing.

Stabilising slopes during basement excavations requires accurate predictions of soil consistency and behaviour; quite a task. In this paper (Liao *et al.*, 2013), slopes of a basement excavation for an office building in Taiwan were stabilised using the drilled shaft method and failed during excavation leading to a forensic investigation. In situ monitoring using inclinometers, settlement plates and water pressure gauges was undertaken together with numerical studies using the computer code Plaxis to simulate step excavation effects on drilled shafts and on ground movement. The slope failure was attributed to design errors such as overestimated soil strength and over-optimistic bedrock condition that resulted in drilled shafts of inadequate size being fixed into weathered bedrock with short sockets – a recipe for disaster.

Water leakage is the most common serviceability failure of building envelopes. A comprehensive methodology for carrying out forensic investigations of large-scale building water leakages is detailed and relevant international codes are referenced by Searls and Stubblefield (2013). An investigation should be well-planned and start with a systematic problem definition – a list of questions to owners/occupants – and a thorough document review that includes construction drawings, specifications, regulations and standards, maintenance records and weather reports. The purpose of the field investigation is to determine why the building leaks, the extent of leakage and possible repairs. A visual survey is an important first step in establishing locations for field testing, including water penetration testing and investigative openings – the latter also provide material samples for laboratory testing. Practical tips are offered in the paper for carrying out field testing, taking good investigation photographs, recording visual observations and producing technical reports; excellent guidance for engineers.

The winter of 2010–2011 inundated the northeast USA with heavy snow accumulations and led to roof collapses across the region in February 2011. Engineers from Simpson Gumpertz and Heger examined over 100 damaged or distressed buildings from

which approximately 40 had a partial or total collapse (Grubb *et al.*, 2013). They found that mistakes in design, construction and maintenance or the occupants' use of the structures caused most of the severe damage. On balance, well maintained buildings that were properly designed and constructed to modern codes did not suffer damage as the actual snow load did not exceed the design snow load. Nevertheless some of these buildings suffered serviceability failures and three case studies are presented illustrating the main problem – building owners do not understand and designers do not fully take into account, the effect of structural deflection on non-structural components. In contrast this is a well-known and understood problem in earthquake engineering and is normally covered by modern seismic codes. This is all about the public perception of acceptable risk (for example a suspended ceiling tile could be distorted under an earthquake load but not under a snow load). This paper should be read by building owners and occupants as it provides useful, simple explanations of structural behaviour that demystify common perceptions of acceptable risks. It is also essential reading for designers as it proves by example that, in most cases of serviceability failure, unnecessary public concern about the performance of structures could have been avoided or minimised by essentially just more careful design and detail of the relevant structural and non-structural components.

As always the editorial panel would like to encourage practitioners and researchers of all disciplines to submit papers or briefings on traditional or modern, large or small and new or old forensic engineering topics from which lessons can be learnt. The editorial panel would also like to cordially invite all our readers to contribute discussion pieces on the papers of this journal.

Finally all readers are encouraged to attend the Fifth International Conference on Forensic Engineering, 16–17 April 2013 at The Institution of Civil Engineers, One Great George Street, London, UK. With a theme of 'Informing the Future with Lessons from the Past' the conference will focus on how lessons learned from failures lead to the development of improved design, construction and management practice (see <http://www.ice-conferences.com/Upcoming-events/Fifth-International-Conference-on-Forensic-Enginee>).

REFERENCES

- Chen S-E and Janardhanam R (2013) Forensic engineering education reform. *Proceedings of the Institution of Civil Engineers – Forensic Engineering* **166**(1): 9–16, <http://dx.doi.org/10.1680/feng.11.00034>.
- Grubb JA, Morse-Fortier L, Dusenberry D and Zona J (2013) Impact of heavy snow accumulation on roof serviceability. *Proceedings of the Institution of Civil Engineers – Forensic Engineering* **166**(1): 41–49, <http://dx.doi.org/10.1680/feng.12.00008>.
- Ingham J and McKibbins L (2013) Briefing: Concrete structures affected by cracking. *Proceedings of the Institution of Civil Engineers – Forensic Engineering* **166**(1): 3–8, <http://dx.doi.org/10.1680/feng.12.00018>.
- Liao J-C, Lin S-S and Yang S-D (2013) Failure investigation of a drilled shaft stabilised slope. *Proceedings of the Institution of Civil Engineers – Forensic Engineering* **166**(1): 17–26, <http://dx.doi.org/10.1680/feng.12.00021>.
- Searls CL and Stubblefield TN (2013) Investigation of large-scale building envelope leakage. *Proceedings of the Institution of Civil Engineers – Forensic Engineering* **166**(1): 27–40, <http://dx.doi.org/10.1680/feng.12.00004>.