Editorial

Louis Le Pen CEng, MICE

Senior Research Fellow, Engineering and the Environment,
University of Southampton, Southampton, UK

Regardless of the changes that may flow from the recent EU referendum, the UK will still have to carry on and face up to its many construction challenges. Two sectors requiring geotechnical engineering ingenuity are rail and energy. Flagship projects such as Thameslink, Crossrail and HS2 are designed to meet renewed rail transport demand, but there are also many less headline-grabbing rail improvement projects that have been taking place, for example the remodelling work around Reading station to improve through capacity. These and other rail projects intend to increase capacity, improve customer experience and mitigate impacts on those living nearby, objectives that can only be met with appropriate geotechnical engineering expertise. In the UK energy sector it is recognised that new generating capacity is needed. Whether energy needs are met by new nuclear, tidal lagoons, onshore and/or offshore wind, biomass, energy piles, fossil fuels or a mix of some or all of the above, geotechnical engineering expertise will be required. Recognising the importance of the UK's and other countries' future energy requirements *Geotechnical Engineering* will publish a themed issue on 'Geotechnics in energy provision', which will be forthcoming in 2017. The needs of the rail and energy sectors serve to highlight the huge latent demand in the UK and other countries for geotechnical engineering expertise. Thus, it is reassuring to see the articles in this October issue showcasing the ability of geotechnical engineers from the UK and overseas to understand complex problems and engineer practical solutions based on sound understanding.

The first paper (Wheeler *et al.*, 2016) presents a new method of carrying out digital image correlation (DIC) to remove the effect of ground vibration of the camera from measured rail movements. With ongoing advances making higher-resolution digital cameras available at reducing cost, DIC is a tool that is routinely being deployed both in controlled laboratory experiments and in the field to gain insights into mechanisms of behaviour. The paper describes a two-camera technique using foresights and back-sights and applies geometric principles to remove ground vibrations of the camera position from tracked image movements. The technique was used to measure rail deflections as trains pass along a route in Canada with underlying soft (peat) soil. This method of measuring rail movements adds to tools that may be used to evaluate railway track system performance, for example, before and after ground improvement works on problematic routes.

The second paper (Hamdan *et al.*, 2016) continues the theme of vibration, in this case as a problem to be understood through the development of a finite-element model. A major difficulty with finite-element modelling of vibration is that in the physical world vibrations radiate through the semi-infinite half-space of soil but artificial boundaries within finite-element models can create artificial reflections. To prevent unrealistic vibration reflection a thin-layer method combined with a paraxial boundary condition was used. The authors used their model to investigate several problems, perhaps the most practically important is the reduction of ground vibration transmission by the provision of an empty trench. Vibration-reduction methods may be used to improve quality of life for neighbours of vibration-causing infrastructure. An obvious application is vibration disturbance from train running: this is a major problem and in some regions has the potential to affect a large proportion of the population. For example, at the time of the 2011 census 11·7 million people lived within 1 mile (1·6 km) of a light rail or metro station in England and Wales – this represents approximately one-fifth of the population.

The third paper (Zhou *et al.*, 2016) develops a probabilistic approach to evaluating the risk of slope failure for steady unsaturated flow conditions. The paper identifies several combinations of rainfall and groundwater level and the associated risk of shallow or deeper-seated failure types. The work has clear relevance to the risks posed from a changing climate.

The fourth and fifth papers are companion papers focusing on physical testing (Jeffrey *et al.*, 2016) and numerical modelling (Knappett *et al.*, 2016) of continuous helical displacement piles. This is a type of screw pile cast in situ. The authors analyse some meticulously performed scale test results to demonstrate that helical displacement piles can offer various advantages and that design calculations can reasonably include the full flange diameter rather than the narrower core diameter that has sometimes been used. These two articles provide design method guidance considering both ultimate and serviceability limit states for practising engineers.

This issue closes with a review of the XVI European Conference on Soil Mechanics and Geotechnical Engineering held in Edinburgh in September 2015 (Winter *et al.*, 2016). This is the first time in 36 years that this conference had been held in the UK and presented a great opportunity for UK engineers to participate. The conference theme was chosen to

Figure 1. Queensferry crossing during the XVI ECSMGE technical tour, which allowed delegates a view of bridge construction from the water

be an inclusive ‘Geotechnical engineering for infrastructure and development’ and this lively report provides a sense of the occasion. Sixty-five countries submitted abstracts and papers, nearly 1000 delegates attended of which 2/3 were international. The conference was also a chance to celebrate the rich contribution to geotechnical engineering from Scotland: Professor William John Macquorn Rankine was born and educated in Edinburgh, while Thomas Telford was also born in south-west Scotland. There are many iconic civil structures in Scotland and perhaps the new Queensferry crossing, under construction and optionally visited by conference delegates, will add to this (see Figure 1).

I hope you will find these articles interesting and of practical relevance and perhaps be inspired to submit a discussion piece or article.

Lastly, as the end of a year approaches, some of our editorial advisory board members will reach the end of their 3-year terms, providing the opportunity for new members to join the board. We are always looking for enthusiastic, technically skilled and high-calibre professionals from both industrial and academic backgrounds to maintain a balanced board representative of all parts of the world. If you are interested please send a 4-page CV to the Journals Editor, Cherise Lopes-Baker (cherise.lopes-baker@icepublishing.com).

REFERENCES

- Hamdan N, Laghrouche O, Connolly D and Woodward PK (2016) Modelling ground vibrations induced by harmonic loads. *Proceedings of the Institution of Civil Engineers – Geotechnical Engineering* **169**(5): 399–409, <http://dx.doi.org/10.1680/jgeen.15.00070>.
- Jeffrey JR, Brown MJ, Knappett JA, Ball JD and Caucis K (2016) CHD pile performance: part I – physical modelling. *Proceedings of the Institution of Civil Engineers – Geotechnical Engineering* **169**(5): 421–435, <http://dx.doi.org/10.1680/jgeen.15.00131>.
- Knappett JA, Caucis K, Brown MJ, Jeffrey JR and Ball JD (2016) CHD pile performance: part II – numerical modelling. *Proceedings of the Institution of Civil Engineers – Geotechnical Engineering* **169**(5): 436–454, <http://dx.doi.org/10.1680/jgeen.15.00132>.
- Wheeler LN, Take WA and Hoult NA (2016) Measurement of rail deflection on soft subgrades using DIC. *Proceedings of the Institution of Civil Engineers – Geotechnical Engineering* **169**(5): 383–398, <http://dx.doi.org/10.1680/jgeen.15.00171>.
- Winter MG, Smith DM, Eldred PJL, Toll DG and Chrimes M (2016) Review of the XVI European Conference on Soil Mechanics and Geotechnical Engineering. *Proceedings of the Institution of Civil Engineers – Geotechnical Engineering* **169**(5): 455–474, <http://dx.doi.org/10.1680/jgeen.16.00020>.
- Zhou A, Li CQ and Huang J (2016) Failure analysis of an infinite unsaturated soil slope. *Proceedings of the Institution of Civil Engineers – Geotechnical Engineering* **169**(5): 410–420, <http://dx.doi.org/10.1680/jgeen.15.00172>.