Editorial

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Welcome to the August 2020 edition of the *Ground Improvement* Journal, for which it has been my pleasure to write the Editorial. The current pandemic has led to unprecedented changes to work and family situations for many: the authors, reviewers and journal editorial advisory board, together with the ICE editorial and production team, are all thanked for facilitating publication of this edition.

An increasing proportion of building and infrastructure development takes place on poor ground, with the ground engineering professional faced with the challenge of providing satisfactory foundation performance in a cost effective and sustainable manner. Use of applicable ground improvement methods, prior to construction, can reduce uncertainty in the ground and consequently ground improvement continues to be of increasing importance within geotechnical engineering. Significant research efforts have been made over the last 40–50 years in our understanding of the fundamental behaviour of the ground, in improving laboratory testing and modelling techniques (including the geotechnical centrifuge), and in development of powerful numerical analysis methods, knowledge which has and continues to be transferred effectively into ground improvement research.

Charles (2002) indicated that there are still many areas where the application of better engineering science could interact beneficially with ground improvement experience-based technology, with one of the desirable consequences of this interaction highlighted by the author, as including a more realistic appreciation of what can be achieved by ground improvement, through the study of well documented case histories of long-term performance. Whilst there has been some progress on these aspects over the last 18 years, it is important that we continue our efforts and strive for more documented case history information for ground improvement techniques, particularly for longer term performance.

The four papers in this edition are very practical, documenting laboratory-based research; their provenance and content demonstrating the truly global and diverse nature of ground

improvement. Additionally, the synergies between the disciplines of ground improvement, environmental geotechnics and engineering sustainability are clearly evident.

In the first paper Guo *et al.*, (2020) investigate electrokinetic and chemical treatment of oil sands tailings. Mature fine tailings (MFT) or fluid fine tailings, are described as a major challenge facing the oil sands industry in Alberta, Canada – the tailings typically containing 70% water and 30% silt and clay sized particles, with low hydraulic conductivities and inherent consolidation difficulties. Whilst electrokinetics (EK) has proved to be effective at dewatering and strengthening oil sands tailings, it is highlighted that it is only limited to the anode area, with further treatment needed to improve the tailings around the cathode area. The research was therefore focussed on evaluating the effects of combined EK and chemical treatment of MFT, with quicklime and Portland cement selected as the chemical additives. Changes in water content, undrained shear strength, plasticity, pore water pH and electrical conductivity, and particle zeta potential after treatment were investigated. It was found that the chemical treatment reduced the material property difference between the anode and cathode but reduced EK-induced water flow and hence the dewatering effects, with EK flow cessation at high chemical dosage. It is concluded that combined EK and chemical treatment of MFT may be beneficial at a low chemical dosage (1% cement or quicklime).

Continuing the ‘geomaterial’ theme, the second paper by Wang *et al.*, (2020) describes experimental work undertaken to investigate the dynamic shear modulus and damping ratio of steel slag with sand-tyre shred particle admixtures. The steel slag and sand were shown to have similar dynamic shear properties, with the dynamic properties of the ‘geomaterial’ principally influenced by the steel slag when the tyre particle mixing ratio was less than 5% and principally by the tyre shred particles when the mixing ratio was larger than 10%. The maximum dynamic shear modulus of the ‘geomaterial’ with a tyre particle mixing ratio of 5% reached 166 MPa and close to that of Fujian standard sand at a confining pressure of

200 kPa. For a tyre particle mixing ratio of 15% the reported maximum shear modulus was 103 MPa and larger than that of Nanjing fine sand at 200 KPa confining pressure. The damping ratio of the 'geomaterial' was found to be mainly influenced by the tyre particles, that is the ratio was higher than for the steel slag. The paper concludes that the dynamic shear modulus and damping ratio of the 'geomaterial' demonstrated its potential for use as an alternative backfill to Fujian standard sand, Nanjing fine sand and steel slag in soft foundation treatment engineering, and in retaining wall backfill engineering. The paper demonstrates useful sustainability advantages in terms of recycling industrial waste and reducing reliance on primary natural resources.

The third paper by Fratalocchi *et al.*, (2020) represents part 2 of two companion papers addressing prediction of shear strength parameters in soil-lime mixture design. In part 1, by Di Sante *et al.*, (2020), quick lime (QL) was investigated – in part 2 hydrated lime (HL) is investigated, using a similar suite of tests to those in part 1. Part 2 describes a comprehensive suite of direct shear tests carried out on specimens of six soils possessing different characteristics treated with different amounts of HL; good correlations were obtained between shear strength parameters and main soil-HL variables (clay fraction (CF) of the soil, the lime content, the curing time and the water content), by multiple regression analyses, validated with data from the literature. The most significant predictors of the shear strength parameters were always found to be the CF of the untreated soil and the lime content. It is also indicated that use of equations in the paper derived from the research should prove useful for preliminary estimates of HL content, in order to obtain shear strength parameters that can ensure stability of a compacted lime-stabilised soil, moreover use of the proposed equations can reduce the number of laboratory tests to be performed in the design phase.

In the fourth and final paper, Najjar *et al.*, (2020) investigate the drained triaxial response of clay reinforced with sand columns. Parameter variations applied included the area replacement ratio, the column penetration ratio and encasement of the column with a geosynthetic fabric. All tests were carried out at three effective confining pressures to characterise the effective Mohr-Coulomb failure envelopes for control clay (unreinforced) specimens and specimens that were reinforced with sand columns. The results of the tests are compared with their undrained counterparts and with other published triaxial tests in the literature. A maximum improvement of 69% was observed in the deviatoric stress for area replacement ratios of 31.7% for fully penetrating sand columns. Comparison between identical drained and undrained tests indicated that the deviatoric stresses were higher in drained tests with the drained response representing an upper bound for the strength of the reinforced clay specimens. When compared with improvements observed in full scale footing tests, the triaxial test results seemed to over predict the per cent improvement

observed in the field bearing capacity, with some discussion on this provided.

I trust you will find these papers useful and informative. Written discussion on the papers is encouraged to further enhance their scientific contribution; details on how you can contribute are provided at the end of this editorial. Finally, I hope that the high-quality papers that are published in the journal will continue to stimulate interest in ground improvement from the research community, further developing and enhancing our understanding of this constantly developing and exciting discipline. Take care and stay safe in these challenging and difficult times.

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