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Editorial

Ground Improvement

Editorial

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Welcome to the May 2024 issue of the *Ground Improvement* Journal and for which it has been my pleasure to write the editorial. Ground Improvement, as a discipline, has expanded rapidly over the last 20-25 years and continues to do so. Sustainability, expanding government targets to achieve net zero and building resilience to climate change, have also become key drivers of some of the research focus. The journal aims to disseminate the latest ground improvement research, developments, and advances, through publication of fundamental research work, but which requires to be of the highest standards and be novel.

Laboratory-based research objectives typically focus on demonstration of proof of concept, but practical application(s) typically require agencies or contractors to see value or benefit from this. Bridging the gap between laboratory-based research and practical industrial application is a challenge. Whilst speculative (laboratory-based) research is important, primarily in case it opens up opportunities for practical (industrial) applications, research that clearly bridges this gap between fundamental (largely laboratory-based) research and industrial practice/application is therefore the desired objective. Better coordination within the research community and its engagement with industry is also needed to achieve such objectives and target the 'unknowns', including industry requirements, while avoiding any unnecessary repetition.

Submissions capturing well-documented case studies, including extended field monitoring, are equally important. These provide an important database, from which academics can calibrate their work (both laboratory modelling and numerical modelling). Opportunities to extend laboratory and numerical modelling-based research to field scale, also assists with this calibration process. Case studies can also provide questions (such as not fully explained/understood or counterintuitive observations) that can lead to or require new fundamental laboratory or analytical research. The journal would also appeal for greater representation from ground improvement practitioners on the editorial panel, who can act as advocates in their industry and encourage well documented ground improvement application case study submissions.

In the light of the above comments, it is proposed to publish a *Briefing Paper,* in the next (July 2024) issue of the journal, to provide further insight and guidance regarding the future direction of the journal, in terms of paper submission expectations (and content), to optimise both the research focus (for the benefit of the wider society) and also dissemination of the latest ground improvement research and application(s).

The May Issue contains five very interesting papers. One paper investigates the performance of soft clay reinforced with granular columns in the laboratory, with the remaining four papers investigating the addition or mixing of additives with problematic soils to enhance engineering performance.

In the first paper, Sivakumar *et al.* (2024) investigate the consolidation and settlement behaviour of soft clay reinforced with granular columns (both single columns and column groups) in the laboratory. Two Rowe cell loading chambers were used on samples of kaolin and Belfast 'sleech' (a natural estuarine alluvium). Tests were first carried out on unreinforced soft clay samples and then samples reinforced with single columns and multiple column configurations. Duration for each test varied between 3 and 4 months depending on test (sample) material (kaolin or 'sleech') and granular column configuration; also to permit the settlement reduction factors based on primary and secondary consolidation to be examined.

The effectiveness of granular columns at reducing primary and/or consolidation settlement was found to be related directly to intensity of loading, stress history of the host (clay) soil and creep characteristics. It was also found that stress concentration ratio reduced with the stress level; also that secondary consolidation also has some effects on the stress concentration ratio.

The second paper by Wong *et al.* (2024), investigates the tensile properties of cement-stabilised clays, in the context of their contribution to seawall design. The tensile properties have been investigated by the authors using direct tension and Brazilian tests, recognising some of the shortcomings of the latter, associated with the formation of multiple cracks during loading. The focus of the research investigation was therefore placed on the fundamental assumption on the crack initiation mechanism.

Based upon a compiled database of cement stabilised soils, a constitutive model, employing finite element analysis, was adapted to consider the cracking and strain-softening characteristics. The approach was found to provide reasonable simulation of the fundamental behaviour of the cement stabilised clay and showed that the tensile properties of such stabilised soil have an important bearing on the stability of the seawall under this type of stabilisation.

Continuing the stabilisation theme, in the third paper Sakr *et al.* (2024) present the results of laboratory-based research, undertaken to evaluate addition of micro-metakaolin (M_m) and ferric chloride ($FeCI_3$) solution to stabilise expansive soils. Bentonite material is used to model the expansive soil, with Improvement properties then investigated using (M_m) and ($FeCI_3$) solution.

The optimum percentages for both additives were determined as 25 and 1% respectively, with the free-swell index of the bentonite, following stabilisation at the above optimum percentages, found to decrease by 54 and 62%, respectively. The swelling pressure of the bentonite material also decreased by 33 and 43% respectively, when mixed with the same optimum values of M_m and ($FeCI_3$) solution. The addition of ferric chloride hence achieved better results than M_m. In addition to reducing swelling behaviour, it was also shown to benefit the soil structure through neutralisation of the negative charges of the modelled expansive soil by the trivalent charge of the ferric chloride.

In the fourth paper, Mypati *et al.* (2024) investigate the durability (consolidation and unconfined compressive strength (UCS) characteristics) and leachate behaviour of an alkali-activated fly ash (FA), as a binder to stabilise expansive soil in deep soil mixing (DSM) applications in the context of seasonal moisture fluctuations and rainwater infiltration.

Overall, the expansive soil stabilised with an optimum binder proportion. A Liquid alkali activator (LAA) to fly ash (FA) ratio (LAA-FA) = 1.5 (ratio investigated ranged from 1.0 to 1.5) was found to be more durable, and the stabilisation products developed during the geopolymerisation are permanent and demonstrated resistance to the extreme wetting-drying environment modelled. XRD and SEM studies revealed that soil treated with a binder ratio of LAA/FA = 1.5, showed crystalline peaks and aggregated structures. It is considered by the authors that this environmentally friendly binder proportion can be adopted for deep-mixing applications for expansive soils.

In the fifth and final paper, Ritter *et al.* (2024) investigate the use of biochar as an alternative to the traditionally used carbon-intensive binders such as cement, to improve peat stability, whilst at the same time sequestering carbon dioxide. Peat from Tiller-Flotten in Norway was investigated. Unconfined compressive strength, water content and pH measurements on biochar, Portland composite cement and peat compositions and a sustainability assessment were carried out.

Biochar was found to have beneficial effects on the geotechnical properties (strength and stiffness) of peat, enhancing the mechanical properties of both natural and cement-stabilised peat. Samples of peat treated with 200 kg/m^3 of biochar and 100 kg/m^3 of cement are shown to have almost identical strength as samples treated with 200 kg/m^3 of cement, but at a strongly negative carbon footprint (i.e. net sequestration of carbon) instead of a significantly positive one.

I trust you will find these papers interesting and informative. Written discussion on the papers is encouraged to further enhance their contribution. Details on how you can contribute are provided on the journal website https://icevirtuallibrary.com.toc/jgrim/current.

I would also highlight that the current (first generation) Eurocode 7: Geotechnical design Part 1: General rules (EN 1997-1 (CEN, 2004)), the European Standards for Geotechnical Engineering, will soon be replaced by a forthcoming second generation of Eurocode 7. Ground Improvement coverage in the current Eurocode 7 is very limited; captured in a one-page sub-section of Section 5 (i.e. 5.5 Ground Improvement and reinforcement). Recognising that this is not representative of the current reality, with ground improvement techniques having a significant range of applications within the ground engineering/geotechnical engineering sector, more detailed coverage of ground improvement will be provided in the new second generation Eurocode 7, within a new Part 3: Geotechnical Structures. A Briefing paper will be published in due course by the journal, which will outline the detail of the changes.

Finally, I would like to thank the authors, reviewers, editorial panel members and Emerald Publishing staff, who have contributed to the May 2024 issue of the *Ground Improvement* journal.

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