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Editorial

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The word ‘sustainability’ was first used in 1972 in the context of men’s future in the book, Blueprint for Survival (Goldsmith, 1972), outlining the need for serious economic and environmental changes. Since then the environmental awareness has been growing, but the coexistence between the economic and sustainable development has not always been easy. In 1987 the Report of the World Commission on Environment and Development: Our Common Future (Brundtland, 1987), also known as the Brundtland Report, has defined the concept of sustainable development as development that ‘meets the needs of the present without compromising the ability of future generations to meet their own needs’.

All the citizens of the World must contribute to the sustainable development to allow a good quality of life for the next generations, but the technical-scientific communities have an increased responsibility. Geotechnical engineering has a crucial role in most construction projects, thus it plays an increasingly important role in the sustainability of the planet.

The Guest Editors are pleased to present this themed issue on ‘Sustainable Geotechnics’ comprising ten accepted papers, covering a wide range of relevant topics to the sustainability in Geotechnical engineering.

Casas *et al*. (2022) studied the usage of Microbially Induced Calcite Precipitation (MICP) for soil stabilization. MICP is an emerging ground improvement technique, consisting of precipitation of mineral calcite in the soil matrix. In this study, calcium-rich silicate quarry fines, dolerite were investigated in both open and closed systems. The study indicated that dolerite quarry fines is a rich source of calcium for MICP applications.

The improvement of the strength properties of red mud wastes by two biopolymers (guar gum and xanthan gum) was explored by Reddy *et al*. (2022). The morphological and mineralogical compositions of stabilised samples, and the unconfined compressive strength for 7, 28, 45 and 90 days were analysed. The efficacy of xanthan gum in improving the strength characteristics of the red mud wastes was higher than that of guar gum. The authors found that the strength improvement by biopolymer stabilisation compares well with the strength attained by high dosages of cement treatment commonly used for high-moisture-content soils stabilisation and with a smaller carbon footprint.

The paper by Das *et al*. (2022) evaluates the usage of a quantitative framework for the combined assessment of the sustainability and resilience elements for a pavement infrastructure project. A pavement project in Texas, USA, was studied which was constructed on sulphate-rich expansive clays, whilst the subgrade was stabilised with lime and fly ash. The framework was developed to provide a decision-making tool to engineers and end-users alike.

The paper by Delgado *et al*. (2022) analyses the usage of steel furnace slag aggregates when used in the ballast layer in railway projects. Traditionally, quarry rocks are used in railway ballast layers. The use of industrial by-products, such as steel furnace slags, in railway ballasts will allow for a more environmentally friendly and lower carbon option for future railways. The influence of the individual particles’ morphology on the mechanical ballast behaviour was studied in detail. The results of the study indicated that the superior performance of steel slag aggregates can be attributed to its higher particle angularity.

The environmental assessment of cement-stabilised lateritic soil/melamine debris blends as sustainable sub-grade and sub-base materials is presented by Donrak *et al*. (2022). The authors reported that melamine debris, resulting from the increased utilisation of melamine products, can be used as a replacement material for improving the index and engineering properties of lateritic soil prior to cement stabilisation. Results from the toxicity characteristic leaching procedure indicated that these cement-stabilised blends can be used safely in sustainable pavement applications, as no significant environmental hazards for the soil and groundwater have been identified.

Xu *et al*. (2022) studied the improvement of dredged sediments by mixing with different types of cement to solidify. These solidified dredged sediments will be used to reclaim the artificial island in

which the island is required to bear dynamic forces such as ocean waves and/or traffic. The authors carried out resonant column tests on the dredged sediments from Dalian Bay, China solidified with different types of cement such as Ordinary Portland cement and sulfoaluminate cements under different confining pressures to compare the effect of solidification. Authors found that for a given type of cement, the maximum shear modulus increases, and minimum damping ratio decreases with increasing confining pressure. It was also found that marine sediments solidified with sulfoaluminate cement achieved the highest maximum and lowest minimum values of shear modulus and damping ratio respectively for the same confining pressure. Marine sediments solidified with Ordinary Portland cement can bear much higher peak shear stress.

The paper by Lucherini *et al*. (2022) studied the effect of vegetation on the soils polluted with galligu and the authors also explored a suitable method of remediation to limit the mobilization of galligu. A suitable type of remediation was required before the re-development of the area adjacent to the river Clyde in Glasgow, UK. Authors carried out the experimental laboratory tests to determine the effectiveness of phytostabilization method using two types of vegetation such as a male dwarf fern (*Dryopteris affinis* (Lowe) Fraser-Jenk) and alfalfa (*Medicago sativa* L.). In the experimental laboratory tests, radial and vertical movements of galligu in the soil as a result of heavy rainfall events were studied. The results indicated that sediments losses were reduced by 84 and 94% under fern and alfalfa vegetation covers, respectively, compared to fallow soil. In comparison, alfalfa vegetation cover was observed to be more much effective in containing galligu contaminants. Based on the experimental laboratory test results, authors concluded that application of phytoremediation on polluted soils is feasible.

The use of polymers to improve bentonite's performance in geotechnical and geoenvironmental applications is becoming an increasingly common practice. The paper by Lieske *et al*. (2022) investigates the importance of polymer chain length and cationicity on the microscopic and macroscopic behaviour of bentonite. The effect of various polymers on the hydromechanical behaviour of MX80 bentonite, as well as the effects of drying and grinding of the bentonite–polymer mixtures were studied. The authors found that the behaviour of polymer-modified bentonite is highly dependent on polymers molecular weight and the corresponding chain length. It is found to be significantly altered by drying and grinding.

Assadollahi and Nowamooz (2022) investigated the long-term performance of foundation soils under three different climate change scenarios by carrying out numerical modelling. Their modelling outputs were validated with the monitoring data such as suction, water content and temperature collected between 2011 and 2014 from the instrumented test site in the south-west of France. Modelling was run to predict for climate change effects between years 2017 and 2050. Their results found that each scenario affects foundation soil differently during the short-term and long-term analyses.

The paper by Trentin *et al*. (2022) presents a quantitative methodology for determining the social sustainability index for environmental remediation projects. The methodology was applied to evaluate the sustainability of four potential remediation options for sediments contaminated with polychlorinated biphenyls and pesticides. This kind of tool can be of great use to support decision makers in the selection of remediation alternatives for contaminated sites, based on societal impacts.

All the papers in this themed issue represent potential steps towards a more sustainable geoengineering practice. The Guest Editors hope that readers will appreciate them and find the inspiration to achieve genuine Sustainable Geotechnics outcomes.

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